A PRACTICAL TREATISE

ON

MATERIA MEDIC

AND

THERAPEUTICS.

BY

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TO THE MEMORY OF

FATHER, MOTHER, AND BROTHERS,

BY THE SURVIVOR.

PREFACE TO THE FIRST EDITION.

To offer to the medical profession a new treatise on Materia Medica and Therapeutics may appear to be a labor of supererogation. The medical literature of this country is already well provided with able and elaborate works on this subject. The learned and encyclopedic volumes of Stillé, based on the empirical method, and the modern and scientific work of H. C. Wood, based on the physiological method, leave almost nothing to be desired. Entertaining such a profound respect for the work of my American colleagues, it may well be inquired why I have ventured to add a new book to those already existing in this department of medical knowledge. A belief, which I trust will not be regarded as egotism, that I have earned the right to address the medical profession, has moved me to the preparation of this work. Several years a teacher of Materia Medica and Therapeutics, I have necessarily formed opinions as to the kind of information which should be contained in a treatise on this subject. As far as such a course of experiment is practicable, I have demonstrated in my lectures the actions of remedies on animals. I have conducted in my private laboratory many independent investigations, and have contributed in this way, I submit with diffidence, some original knowledge to the subject of therapeutics. The information thus acquired has been supplemented by twenty-two years of clinical experience as a practitioner of medicine. Under these circumstances, I am induced to believe that my professional brethren, and medical students, will hold that I am entitled to a hearing.

A volume on Materia Medica and Therapeutics should, in these days, present some new features of importance if it would worthily occupy a place alongside of the excellent works now accessible to American readers. An examination of this treatise will disclose the fact that it differs from other works in its scheme of classification, in the subjects discussed, and in the very practical character of the information. In the present state of our knowledge, it is impossible to make a classification free from defects, and I do not claim for mine that it is superior to others—only that its simplicity is a point in its favor. As respects the subjects treated of, it will be seen that the most elaborate section is that on aliment, and that remedies have been introduced not usually referred to by therapeutical writers. In the treatment of individual agents, I have, usually, adopted the description of the "United States Pharmacopœia," and have omitted botanical and chemical details, unless they are necessary to elucidate physiological questions, or to facilitate intelligent prescription-writing. All pharmaceutical questions are most thoroughly handled in the "Dispensatory" of Wood and Bache, and this kind of knowledge is more the province of the druggist than of the physician.

In describing the physiological action of drugs, two methods may be pursued: to present in chronological order a summary of the opinions of various authorities on the subject in question; or, to condense in a connected description that view of the subject which seems to the author most consonant with all the facts. I have adopted the latter plan, from a conviction of its advantages for the student, and of its utility for the practitioner. The authorities which I have utilized in making up my opinions are placed at the end of each article, in order to avoid interruptions in the methodical descriptions.

As respects the therapeutical applications of remedies, I have, as far as practicable, based them on the physiological actions. Many empirical facts are, however, well founded in professional experience. Although convinced that the most certain acquisitions to therapeutical knowledge must come through the physiological method, I am equally clear that well-established empirical facts should not be omitted, even if they are not explicable by any of the known physiological properties of the remedies under discussion.

My best acknowledgments are due to John Chatto, Esq., the learned Librarian of the Royal College of Surgeons, London, for numerous courtesies extended to me during my visits to Lincoln's-Inn-Fields.

ROBERTS BARTHOLOW.

120 WEST SEVENTH STREET,
CINCINNATI, OHIO, *June*, 1876.

PREFACE TO THE SECOND EDITION.

THE success of my treatise has exceeded any reasonable expectations, and, under the circumstances, is peculiarly gratifying. Constructed on a somewhat different plan from the ordinary text-books, and brought into direct competition with several very able and well-established works on the same subject, I could not but feel that its progress to professional favor must necessarily be slow. That several considerable editions have been exhausted in the first year of its publication, and that the demand for the book has not abated, indicate that its appearance was opportune, and that its plan and execution are approved by the medical profession.

In this new edition various improvements have been made, and articles on the following subjects have been inserted:

Beverages.
Vegetable Acids.
Picrotoxine.
Caffein.
Grindelia.
Heat.
Cadmium.
Cannabis Indica.
Guarana.
Phytolacca.
Digestion-Ferments.
Cerium.
Cuca.
Pulsatilla.
Ailantus.

Besides the new articles, additions have been made at various points. Notwithstanding these additions, the bulk of the work has not been materially increased, and its practical character has been strictly maintained.

Increasing observation satisfies me that an author, writing on such a complicated topic as the actions and uses of remedies, owes it to his readers to present them the results of his matured experience and his most composed judgment, rather than lay before them a multitude of opinions, experiments, and reports, out of which they must construct, if they can, a consistent theory, or form an adequate conception of the nature and relations of all the facts. But few readers will give the time to so tedious a task, and the smallest number are fitted by education, training, and habits of mind, for working out results from such a complicated mass of materials. While every author is bound to indicate to his readers the sources of his information, it is equally his duty to present that information in the form most available for immediate use.

The classification of remedies must continue in an unsatisfactory state, and any scientific scheme is, at present, hopeless. The distinguished and able Prof. Edward H. Clark, M. D., of Harvard (Boston), in his review of this work (*The American Journal of the Medical Sciences*, January 7, 1877), justly remarks as follows:

> "No scientific classification of the materia medica is possible in the present state of science. Writers are, therefore, justified in adopting any classification that may happen to suit their fancy, or in adopting none at all."

Notwithstanding a scientific arrangement is unattainable, it is certainly convenient to group together those agents which are physiologically and therapeutically allied. I have adopted, in part, the classification proposed, in 1863, by Dr. Chambers ("Renewal of Life," etc.), using the two great divisions of "agents promoting constructive metamorphosis" and "agents promoting destructive metamorphosis." As respects the assignment of individual remedies, in accordance with certain conceptions of their powers and actions, the arrangement adopted is entirely my own.

The omission of certain botanical, chemical, and pharmaceutical details, except such as are necessary to a just appreciation of the physiological actions, or to "facilitate intelligent prescription-writing," has been decidedly commended by the reviewers, and by my readers generally. In the present state of pharmacy, knowledge of the kind omitted would prove useless, in the main, to physicians, even if acquired. I beg, however, to call the attention of my readers to the fact that the official designation of the remedy, its pharmaceutical preparations, its chemical composition, and its active principles, are carefully stated, and should be mastered by every student. This knowledge of the *technik* of his *armamentarium* is an indispensable requisite to its skillful use.

The author has a strong conviction that, in the future of therapeutics, the law or principle of physiological antagonism must play an important *rôle.* He has indicated more fully, probably, than any other systematic writer, the application of this principle in practical therapy.

In the preparation of the articles I have studiously endeavored to preserve the harmony and proportion of the parts, and have treated them with a fullness and particularity according to their relative importance. In this way it may appear to some of my readers that I have exaggerated some topics, and have treated others, equally important, with indifference. Having given careful consideration to this subject in the course of my preparations for the new edition, I conclude that the judgments formed in the first instance are confirmed by more extended study and observation.

Any one discovering an error of any kind in this edition of my treatise will place me under great obligations by reporting it to me without delay.

I am indebted to my assistant, Dr. Frederic Kebler, for the revision of the indexes.

ROBERTS BARTHOLOW.

120 WEST SEVENTH STREET, CINCINNATI.

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A TREATISE

ON

MATERIA MEDICA AND THERAPEUTICS.

SCHEMA.

PART I.—*Modes in which Medicines are introduced into the Organism.*

PART II.—*The Actions and Uses of Remedial Agents:*

Those used to promote constructive metamorphosis.

Those used to promote destructive metamorphosis.

Those used to modify the functions of the nervous system.

Those used to cause some evacuation from the body.

PART III.—*Topical Remedies.*

IN this scheme the action of the medicine is followed from its introduction into the stomach, to its exit through the organs of excretion. Some remedies are used solely or chiefly for their influence on the primary assimilation; as, for example, pepsin, the simple bitters. Other remedies, with or without affecting the function of digestion, modify the process of assimilation, either promoting the construction of tissue, or the retrograde or destructive metamorphosis. Iron may be taken as a typical example of the one, and mercury of the other mode of action on the function of assimilation. The therapeutical application of these remedies is based in this conception of their physiological action.

A large group of remedial agents is used not to influence the metamorphosis of tissue, but simply to modify the functions of the nervous system, of which morphia and strychnia may be taken as types. It is true that probably no medicinal agent modifying function does so without affecting structure; but, in the present state of our knowledge, we are, in respect to some of them at least, unable to designate the tissue-changes which they induce.

To the class of evacuants belong emetics, cathartics, anthelmintics, and diuretics. These remedies are either so irritant as to excite speedy action for their expulsion, or they are eliminated by the organs on which they appear to have a selective effect. When the movement for their expulsion terminates, as a rule their action ceases. Some of these irritant emetics and cathartics, acting locally merely, might be classed with topical remedies, but such an arrangement would destroy the continuity of the subject.

Topical remedies act upon the part to which they are applied. Absorption is not necessary to, and indeed hinders the local effect; hence, any systemic effects produced by them are accomplished through the agency of the nervous system.

PART I.

ROUTES BY WHICH MEDICINES ARE INTRODUCED INTO THE ORGANISM.

I.

THROUGH THE EXTERNAL INTEGUMENT.

By this tissue medicines are applied in the following modes:

Enepidermic.
Epidermic.
Endermic.

Enepidermic.—In this method, the medicament is placed in contact, only, with the epidermis, and friction, to hasten absorption, is not employed. Although the epidermis opposes a strong obstacle to absorption, it does not entirely prevent diffusion into the blood, as numerous facts show. The skin may be considered a colloidal septum. The rate and degree of absorption of any medicine will depend, in large part, on its power of diffusion. Various circumstances influence this—for example, the chemical position of the agent to be diffused. On one side of the colloidal septum—the skin—lie the blood-vessels, containing an alkaline fluid. An acid fluid on one side of the osmotic membrane, and an alkaline fluid on the other, are conditions most favorable to osmosis. Experiments are wanting on this point, but it is a reasonable presumption that solutions of medicinal substances, acid in reaction, will find their way most readily into the blood.

Besides the epidermis, the sebaceous matter of the skin offers more or less positive obstruction to cutaneous absorption. Medicinal substances in solution in water, therefore, very slowly permeate the skin to enter the vessels. Waller, who has made very careful experiments, has ascertained that alkaloids dissolved in chloroform are readily transferred through the skin into the blood, and produce characteristic phenomena, while "alcoholic and aqueous solutions are either not at all, or very slowly, absorbed."

His observations were made with chloroformic solutions of aconite, atropia, strychnia, and morphia. Waller further ascertained that alcohol mixed with chloroform did not retard absorption, but alcohol alone caused an outward osmotic flow. It follows from these facts that, if, in the application of a medicinal agent to the skin by the endermic method, the object be to promote absorption, the remedy should be dissolved in chloroform, or in a mixture of alcohol and chloroform, and

EPIDERMIC.—This method differs from the enepidermic in

tion is employed to promote absorption by forcing the medicament between the cells of the epidermic layer. Various agents are used in this way, as mercurial ointment in syphilis, cod-liver oil, and other fats, in wasting diseases, and ointments of various kinds for the relief of local lesions, etc. The evidence is conclusive that in this way systemic effects are produced.

ENDERMIC.—As the epidermis is the chief obstacle to cutaneous absorption, it is sometimes removed by blistering, so that the medicament may come into immediate contact with the derma. The mode of proceeding by the endermic method is as follows: a piece of flannel, patent lint, or cotton cloth, is moistened with *aqua ammoniæ*, and when placed on the skin is covered with oiled silk to prevent evaporation. When the blister is raised the epidermis is removed with scissors. A less painful, but slower method, is the application of a cantharides-plaster, followed by a poultice to raise the blister. The medicinal agent, in a finely-powdered state, is sprinkled over the raw surface, and is rapidly absorbed. Morphia, atropia, strychnia, and quinia, are the most important agents used in this way.

The endermic method is a useful resource to the therapeutist, but the opinion of Brown-Séquard is hardly admissible, that the extensive use of the hypodermic method has caused the endermic to be unwisely neglected. There are decided objections to the endermic method: it is painful; absorption is somewhat uncertain; ulceration of an intractable character may occur. It has these advantages in its favor: it may be used in cases of irritable stomach; it may be conjoined with counter-irritation; it is sometimes quite effective.

THROUGH THE INTERNAL INTEGUMENT.

APPLICATIONS TO THE BRONCHO-PULMONARY MUCOUS MEMBRANE.—By the method of *insufflation* solid medicinal agents in a finely-divided state are applied to various parts of the respiratory tract. Insufflation-tubes with a rubber air-bag attached are now found at the instrumentmakers'. The powder, contained in a chamber intended for its reception, is forced by the compression of the air-bag through the straight or curved delivery-tube of the instrument. Powders may be projected by such an apparatus into the fauces, larynx, and anterior and posterior nares. In the absence of an insufflator, a simple glass tube or goose-quill may be used for the purpose—the powder being blown in by the operator, or drawn in by a forcible inspiration by the patient.

The method of insufflation is a useful mode of making local applications to the nares, fauces, epiglottis, and the aryteno-epiglottidean folds, but it is of little utility as a means of reaching the larynx and trachea, for, as is well known, the glottis is exceedingly intolerant of foreign bodies whether solid or gaseous. By this method we can use tannin, the zinc salts, nitrate of silver, alum, morphia, etc. Any remedy thus applied should be in small quantity, should be minutely subdivided and mixed with some unirritating, impalpable powder, so as to insure uniform distribution over the surface to be acted upon.

The *nasal douche* is a mode of applying remedies to the nasal passages now much practised. This consists of a bottle or funnel-shaped reservoir to contain the medicated fluid, and a flexible rubber tube to which is attached a hard-rubber or glass nose-piece. The reservoir being placed on a higher level than the head, the nose-piece adjusted and the mouth being kept open, the fluid is permitted to flow. As when the mouth is open, the patient breathing quietly, the palate applies itself closely to the posterior wall of the pharynx, it is obvious that the fluid will be conducted from the one to the other nostril and thus make its exit. Not every patient can succeed perfectly in the performance of this feat. In some persons, even when breathing quietly through the open mouth, the veil of the palate does not apply itself perfectly to the posterior fauces and the fluid flows into the œsophagus. Other persons cannot refrain from attempts at swallowing when the fluid reaches the posterior nares. In such instances the use of the nasal douche may be attended with ill results. As has been shown by Moos, Roosa, and others, and as I have myself observed, the fluid may pass through the Eustachian tube into the middle ear, giving rise to destructive inflammation and suppuration. If pain in the ears follows its use, it is quite certain that mischief will result if the douche be persisted in. The following rules should be adhered to in making applications by this method:

The fluid used must be tepid.

The first applications must be bland and unirritating.

The applications, if strong enough to excite irritation, must not be used frequently.

Under the most favorable circumstances this mode of treating diseases of the nasal passages has very limited utility, for the fluid reaches but a part of the Schneiderian mucous membrane. It is a useful means of cleansing the nares, and for applying deodorizing agents to correct fetor. Chlorides of sodium, potassium, and ammonium, permanganate of potassa, carbolic acid, iodine, and many other agents of the same kind, are applied by means of the nasal douche.

An ordinary Davidson's syringe, made to act as a siphon, may be used in the same way as the Weber's or Thudichum's nasal douche. The mode of proceeding with this instrument is as follows: the vessel containing the medicated fluid is placed on a higher level than the patient's head; the syringe is filled by compressing the bulb to expel the air, and then inserting the suction-pipe in the fluid; the nozzle of the delivery-pipe is put into the nose, when a steady stream will discharge into the nostril and escape by the other.

The method of *inhalation* is more generally applicable to the treatment of diseases of the broncho-pulmonary mucous membrane. Iodine in vapor, iodoform, sal-ammoniac, bromine, and other volatilizable solids and gases, may be readily and advantageously applied in this way. A convenient mode of using iodine is the following: make a cone of stiff paper, so that the smaller extremity shall fit the mouth or nose, or both; drop some tincture of iodine into a cup of hot water, so placed that the vapors will ascend through the funnel, the larger mouth of which is in position to intercept them. Iodoform vaporized on a warm plate or saucer may be similarly conducted into the mouth or nose. Some drops of bromine may be put into a warm vial, and the vapor be cautiously inhaled. Several forms of inhalers are now made for applying muriate of ammonia vapor, as it is formed by the combination of ammoniacal gas and the fumes of hydrochloric acid.

The above methods, although not without utility, are not equal in effectiveness to the method of *pulverization* or *atomization* of medicated fluids. Air or steam is the motive power in the various forms of apparatus used for reducing solutions of medicinal agents into spray. Of those now in use, the hand-ball apparatus for air, and Siegle's apparatus for steam, are the principal. Whether air or steam be used for pulverizing the medicated fluid, the essential parts of an atomizing apparatus consist of a cup for containing the solution to be pulverized, a vertical tube terminating in a fine capillary extremity and dipping into the medicine-cup, and a tube communicating with the steam-boiler or air-bulb, and placed at right angles to the vertical tube. When air or steam is forced through the horizontal tube, over the capillary orifice of the vertical tube, the air in the latter is rarefied and the fluid rises into it, until, reaching the top of the tube, it is broken up into fine spray by the impact of the horizontal column of air. It is obvious that, provided with suitable tubes, spray may be applied to the nares, anterior and posterior, to the pharynx, epiglottis, and larynx. The utility of applications made in this way to these parts is now conclusively established. Although it has been a question whether any quantity of medicated spray passes the chink of the glottis, it has been proved experimentally that a minute quantity does actually enter the trachea. The efficacy of inhalations of subsulphate of iron in pulmonary hæmorrhage is a clinical fact confirmatory of the experimental demonstrations. The inhalations of substances in a state of vapor, and atomized in affections of the parts beyond the larynx, have thus far been rather disappointing, except, it may be, the treatment of pulmonary hæmorrhage by iron inhalations.

In using the various inhalations, some precautions must be taken to avoid harm. Strong applications should not be made in the beginning of the treatment. The mucous membrane should be accustomed to the impact of such unirritating substances as warm water and tepid solutions of common salt and chloride of ammonium, before commencing the use of tannin, the zinc, copper, and silver salts, etc. For cleansing the mucous membrane and removing fetor, common salt, carbolic acid, iodine, and the sulphides are useful, and as astringents and deodorizers, the sulpho-carbolates of zinc, soda, etc. The most effective application for the cure of diseased states is nitrate of silver, but it should be kept in mind, in using this agent, that the handkerchiefs and linen of the patient will be soiled. Solutions of nitrate of silver are best applied by means of the hand-ball atomizer, tubes of various shapes, according to the locality, being inserted into the anterior and posterior nares, pharynx, or glottis, as the case may be. Should the steam atomizer be used for making application of the various salts named above, the face of the patient should be protected by a shield.

Applications to the broncho-pulmonary mucous membrane are also made use of to procure absorption of the materials applied, and thus to produce systemic effects. Anodynes for the relief of cough, difficult breathing, painful affections of the heart, etc., are applied to the fauces and larynx by means of the steam atomizer. Various preparations of opium, cannabis Indica, belladonna, and nitrite of amyl, are employed in this way. The most effective method of treating an asthmatic paroxysm is by means of a cigarette containing various narcotic substances.

Applications to the Gastro-Intestinal Mucous Membrane.—The stomach is the organ most usually selected for procuring absorption of remedial agents. Diffusion through the walls of the stomach into the blood is by no means definite in rate, or in the quantity passed, even with the same medicament and in the same individual. The presence of fluid or food, the chemical reactions which may ensue, the state of the mucous membrane, the blood-pressure in the veins, and the condition of annexed organs, are circumstances modifying the rate and degree of absorption. The stomach empty, the mucous membrane in a healthy state, veins not turgid, are the conditions most favorable for rapid and perfect absorption. Crystalloidal substances in solution, which pass by simple osmosis into the vessels, are taken up more rap-

and perfectly than colloidal substances, which require preliminary digestion and solution. It follows, therefore, that medicines in solutions not intended for a merely local action on the stomach mucous membrane, and not irritant in character, as salines, alkaloids, etc., should be administered when the stomach is empty. Substances that are irritant, or that require digestion and solution, or that, like iron, are intended to supply a material to the blood in which it is deficient, are best administered during the process of digestion. On the other hand, many of the metallic salts precipitate pepsin and thus derange digestion, whence it follows that they should not be given after food, if unimpaired digestion be essential to the safety of the patient.

Although it is true that medicines in solution are more readily taken up than solids, yet many of the latter are absorbed with great facility, as metallic iron, calomel, etc., which are rendered soluble by the gastric fluids. The chemical changes induced in medicines by the gastric juice are by no means well understood. How individual agents are affected is a subject to be considered hereafter.

The following are the chief forms in which medicines are administered by the stomach:

Powders are medicines reduced by mechanical subdivision, or by precipitation, to the finest possible state. Those soluble in water are usually administered in that menstruum. If insoluble, they may be suspended in water by means of sugar, sirup, solution of gum, glycerine, or they may be rubbed up with some innocuous powder, as sugar, sugar of milk, liquorice-powder, etc.

Pills are small masses of medicine made into a globular shape, by means of an extract, conserve of roses, sirup, or glycerine. A pill should not exceed five grains in weight, including the excipient, and, as a rule, it should be smaller than this. To cover the taste, pills may be coated with sugar, gelatine, silver, or gold foil. It should not be overlooked that pills too long kept, especially when sugar-coated, become very hard and insoluble, and therefore without activity. Extemporaneously, pills may be covered with fine tissue-paper, or enveloped in a raisin, to cover the taste of the ingredients.

A mixture is a suspension of one or more insoluble substances in the vehicle, by means of sugar, gum, glycerine, treacle, albumen, etc. The term *emulsion* is restricted in application to the mixture of oil and water, in which the oily particles are suspended mechanically by rubbing them up with water and gum.

Extracts are solid and fluid. The solid extract may be aqueous or alcoholic; in the one case water, in the other, alcohol, being the menstruum employed to extract the active and soluble principles. An extract is *solid* when evaporation is carried far enough to produce a soft paste or a dry mass; it is *fluid* when sufficient alcohol and water are retained to give the proper fluidity.

Infusions are such solutions of active and soluble principles as can be extracted by digesting the crude drug in water, cold or at a temperature short of boiling. When water at the boiling temperature is used, the resulting solution is termed a *decoction*. Cold infusions are, as a rule, to be preferred to decoctions, for, at the temperature of boiling water, many active principles are decomposed or volatilized.

Wine, vinegar, and alcohol, are also used as menstrua.

Capsules are hollow cylinders or cones of gelatine, to contain offensively-tasting substances, as copaiba, oil of sandal-wood, etc. In the stomach the gelatine is dissolved and the medicament liberated.

Lozenges or Troches, button-shaped masses, are sometimes introduced into the stomach, but usually these bodies are intended to be dissolved slowly in the mouth, to exert a local action on the fauces.

Wafers are circular disks with a central cavity for holding the medicine. They are made of isinglass.

A Suppository is a conical mass of cacao-butter, or wax and cacao-butter, with which is incorporated a medicament. They are applied to the rectum, vagina, and urethra.

Clyster, *Enema*, *Lavement*, are medicated solutions to be thrown into the rectum.

Although the rectum as an absorbing surface is inferior to the stomach, medicines are frequently introduced by this organ with great advantage. Some medicines enter the blood more quickly by the rectum than by the stomach, but, as a general rule, absorption is slower by the former organ. If the mucous membrane of the rectum be irritable, or if the substances introduced be irritating or bulky, they will not be retained. As the contents of the rectum are alkaline, solids requiring an acid for their solution will not be taken up. Acid solutions of medicinal agents, on the other hand, are readily enough absorbed, provided the quantity of acid present be sufficient to maintain solution. As a general rule the mineral salts act chiefly locally on the mucous membrane of the rectum and enter the blood in small quantity. The salts of the alkaloids, on the other hand, are absorbed with facility. Alkaloids insoluble unless in presence of an acid are not absorbed with the same rapidity and completeness by the rectum as by the stomach, unless they are administered in acid solution. The salts of morphia, atropia, and strychnia, in solution, are absorbed as quickly, and the last named more quickly by the rectum than by the stomach.

Remedies administered by the rectum may be in solution suspended in some menstruum, or incorporated with a soap or fat in the form of suppository. The solution used should have the temperature of the rectum (about 100° Fahr.). The quantity administered should not exceed two fluid-ounces of solution. Before introducing a medicated solution or clyster into the rectum, this organ should be emptied of fecal matter by an ordinary enema.

Administration of remedies by the rectum is an important resource to the therapeutist in cases of inability to swallow, irritable stomach, and in children's maladies. Unfortunately, this organ soon becomes intolerant, the mucous membrane irritable, and the medicament is either at once rejected or absorption delayed.

Applications to the Genito-Urinary Mucous Membrane.—Brown-Séquard has proposed to utilize the bladder for securing absorption of remedial agents in cases of great intestinal disorder, as in cholera. Experiment has shown that morphia, for example, is taken up with considerable rapidity by this viscus.

Topical applications to the urethra and vagina are very frequently made, usually in the form of astringent injections. Suppositories, variously medicated, are also occasionally used in the treatment of affections of these parts.

III.

BY THE SUBCUTANEOUS AREOLAR TISSUE—THE HYPODERMATIC OR HYPODERMIC METHOD.

The term *hypodermic* is used in conformity with the nomenclature already existing—as "epidermic," "endermic," etc. As the term indicates, by this method the medicine is applied to the subcutaneous areolar tissue. This does not include the method of "inoculation," introduced by Lafargue, nor that proposed by Luton and Bertin, which consists in the injection of irritants into diseased tissues. It is obvious that by the hypodermatic method medicines can be introduced only in the state of solution. To introduce the solution under the skin, a special instrument is necessary. This is the now well-known hypodermic syringe—a small syringe having a capacity not to exceed a drachm—the nozzle being a hollow needle having a lancet-shaped extremity for easily transfixing the skin. These instruments are various in form and construction, and are made of gold, silver, glass, or hard rubber. The most efficient instrument for ordinary use is the silver hypodermic syringe described by the author. The piston-rod of this instrument should be semi-cylindrical and should be graduated for minims on its flat side, to indicate the quantity of solution contained in the barrel. Glass hypodermic syringes break easily, and the mountings work loose and give way. Now, however, the glass cylinder is in part inclosed in a metal sheath, for greater strength and security. A graduated hypodermic syringe should not be used until the exact value of the divisions of the scale has been determined by comparison with a standard minim-glass.

A medicine employed for hypodermatic use should be capable of perfect solution in the menstruum, which is usually distilled or pure water. Particles of medicine undissolved are not only not in a condition for ready absorption, but are irritant to the tissues, producing inflammation and abscess. The solution for hypodermic use should be free from foreign matter of every description and should be neutral in reaction, or, at least, without decided acid or alkaline reaction. Any substance which will coagulate the blood or produce violent local irritation is unfit for hypodermic use. A solution of even a neutral substance should not be too concentrated. Clean water, free from visible impurities, is entirely harmless, and the quantity of fluid injected is, within certain limits, a matter of indifference, provided suitable care be used in selecting the site and injecting. On the other hand, concentrated solutions are more apt to produce local irritation than dilute solutions. Moreover, a drop too much of a concentrated solution of a powerful alkaloid may produce an alarming, if not dangerous state. In ordinary syringes a few drops remain at the bottom of the barrel and in the needle—whence it follows, in using strong solutions, it is difficult to inject the precise amount desired.

Solutions of alkaloids, too long kept, become unfit for use, hypodermically, by reason of the development in them of a *penicillium*, a minute organism which grows at the expense of the alkaloid. Fresh solutions should be made when needed. When hypodermic injections are used infrequently, it is preferable to prepare an extempore solution, using powders of a definite strength. Filtered river, melted ice, or rain water, may be used for dissolving the powders. Solutions prepared extemporaneously from ordinary spring or rain water are found to produce less inflammation, and are less likely to be followed by abscess, than solutions prepared with pure distilled water which have been kept for several days.

In practising the hypodermatic injection it is important to avoid puncturing a vein. Serious depression of the powers of life and sudden and profound narcotism have been produced by injecting a solution of morphia directly into a vein. Fatal collapse may ensue from injecting air into a vein along with the narcotic solution. Bony prominences ought to be avoided, and also inflamed parts. It is not necessary to follow Wood, the discoverer of the hypodermic method, who advised that the solution be inserted at those points where pain can be awakened by pressure (the painful points of Valleix). Some exceptions to this rule undoubtedly exist. The arm, the abdomen, the thighs, the calves of the legs, and the back, are suitable places. Eulenberg makes the assertion that the effect is slower when the injection is made in the back, but I have not observed this difference.

IV.

BY THE VEINS.

The injection into the veins of medicinal agents is too dangerous a procedure to be lightly undertaken, and is admissible only in emergencies. Formerly, before the introduction of the hypodermic method, the injection of medicines directly into the blood was suggested and occasionally practised in cases of asphyxia, in the collapse of cholera, in the insensibility due to narcotic poisons, etc. At present this method is restricted within narrower limits. Some remarkable results have been obtained by the injection of a saline solution in the veins in cases of the *collapse of cholera.* Unfortunately, the appearances of improvement, which are very remarkable, are not usually sustained, although Little reports five recoveries out of twenty apparently hopeless cases treated in this way. Dr. Hilton Fagge has recently reported a case of *diabetic coma*, in which the injection of twenty-six ounces of a warm solution of salines (phosphate and chloride of soda) produced an astonishing improvement in the condition of the patient. A suitable saline solution for intra-venous injection may be made of phosphate, carbonate, and chloride of sodium, dissolved in water at the temperature of 100° Fahr. until the specific gravity of 1020 is attained. The instruments employed for transfusion of blood may be used for the intra-venous injection of salines, especially the apparatus of Dr. Aveling for immediate transfusion, or the *aspirateur* modified according to the plan of Dr. Howe, of New York, when used for transfusion mediate or immediate. In the absence of these, an ordinary Davidson's syringe may be used for this purpose by attaching to it suitable canulæ.

Halford, of Australia, has recently practised the *injection of ammonia* into the veins, in the treatment of the bite of venomous snakes. He employs one part of the stronger *aqua ammoniæ* to two parts of distilled water, the injection being made with an ordinary hypodermic syringe. A vein in a convenient situation is selected, the needle is inserted into it, and the solution of ammonia is thrown in gradually. The operation may be repeated as necessary, the guide to the repetition of the injection being the state of the circulation. Fayrer shows that this practice is not successful in the systemic condition caused by the bite of the venomous snakes of India, and the special committee of the Medical Society of Victoria, appointed to investigate the subject of the intra-venous injection of ammonia, report adversely to the claims of Halford. The proposer of this expedient has, at least, demonstrated the safety of the intra-venous injection of ammonia; and, although his first claim has been shown to be incorrect, the method itself has been utilized in other maladies: for example, in *choloroform* *asphyxia*, *opium narcosis*, *hydrocyanic-acid poisoning*, etc. It has been used, not with encouraging success, however, in septic states with a tendency to the coagulation of the blood in the larger venous trunks. Failure of the heart's action and *thrombosis of the pulmonary artery*, *post partum*, are also indications for the intra-venous injection of ammonia.

TRANSFUSION.—This consists in an operation for substituting healthy blood for the abnormal fluid occurring in certain diseases, and for supplying blood in cases in which a deficiency exists by reason of hæmorrhage. Ordinarily the blood of a healthy adult is used in transfusion, because ever since the time of Blundell it was supposed the blood of an animal would not functionate properly in the arterial system. This notion is now, however, fully exploded, and Gesellius has especially shown, in his elaborate monograph on transfusion, that lamb's blood will answer the same purpose in the human system as human blood.

As the red globule is the vivifying constituent of the blood, and as the fibrin is non-essential to the most important office, at least, of the circulating fluid, it is obvious that defibrinated blood may be used for transfusion. According to the statistics collected by Gesellius, of one hundred and forty-six cases of transfusion with blood without defibrination, seventy-nine, or 54.11 per cent., were successful, and, of one hundred and fifteen cases in which defibrinated blood was used, seventy-nine, or 68.70 per cent., proved fatal. Mr. Higginson, of Liverpool, reports thirteen cases occurring under his own observation, in which mediate transfusion with pure blood was employed, with the result of six successful. The injection of defibrinated blood is free from one source of danger—the introduction of clots into the circulation—which, as Panum has shown, will be followed by the disastrous result of multiple embolisms, or thrombus of the pulmonary artery. Separating the fibrin, however, renders the blood much less capable of performing its office. The necessary agitation in order to coagulate the fibrin injures the blood-globules, and the fibrin itself is necessary to prevent transudations and the recurrence of hæmorrhage. With the improved instruments now used for the operation, and with the exercise of the necessary care, there need be no formation of clots, the chief danger in the use of blood containing its fibrin.

Transfusion may be *mediate* or *immediate*. Mediate transfusion consists in the reception of the blood in a suitable vessel, and its transference by means of an injecting apparatus into the veins of the patient. Immediate transfusion consists in an apparatus for making direct communication, from the vein of the person or animal furnishing the blood, with the vein of the patient receiving it. A number of appliances have been invented for mediate transfusion. Martin, of Berlin, has used in his operations a glass syringe provided with a suitable canula for insertion into the vein. Belina invented an apparatus consisting of a receiver for the blood, a hand-ball like that of the spray-douche, and a flexible tube provided with a stop-cock and canula. Belina, who has treated at great length of the operative procedure, decides that all forms of syringes are objectionable. Higginson proposed and has used successfully an instrument similar to the enema-syringe invented by him. This apparatus can, however, only be used for mediate transfusion. As immediate transfusion is to be preferred, as a rule, it were better to be provided with a suitable instrument for this operation. The instrument invented by Dr. Aveling, and presented to the Obstetrical Society of London in 1864, is at the same time the simplest and most effective. This consists of a hand-ball and flexible tubes like a Davidson syringe, but without valves. There are two canulæ attached to either extremity of the flexible tubes—one for insertion into the vein furnishing the blood, and the other for insertion into the vein receiving it. The small size Davidson syringe will answer perfectly well by removing the valves, the action of which tends to separate the fibrin, and fitting to the flexible tubes suitable perforated needles or canulæ. In using Aveling's instrument it must be first put into water at the temperature of 100° Fahr., and it must be filled with warm water, or better, a warm solution of phosphate and chloride of sodium of a specific gravity of 1020. The object of this is to exclude the air from the apparatus. The next step consists in inserting the canula in a vein—usually of the forearm—of the person or animal furnishing the blood, and in a position so that the blood-current will be in the direction of the current in the patient receiving it. Should the veins of the patient be collapsed, the skin overlying those at the elbow may be transfixed and raised, which will bring into view a vein into which the canula may be inserted—care being used here that the direction of the current shall be toward the heart. The canulæ can be held in position by the fingers of assistants. The operator compresses the bulb gently, pressing at the same time the supply-tube between the thumb and finger of the other hand, in order to prevent a reflux of the fluid. When the bulb is emptied, the delivery-tube is pressed between the thumb and finger shifted from the supply-tube, and the bulb is allowed to fill with blood from the source of supply. In this way, successive charges of fresh blood can be delivered without difficulty into the patient's vein. The *aspirateur* may be used in the same way for immediate transfusion, as has been suggested by Dr. J. W. Howe, of New York, who has used it successfully. He advises the substitution of smaller tubes than those which accompany this instrument, and he has devised suitable canulæ for the veins.

The quantity of blood, which it is advisable to introduce, varies from four to eight ounces. The smaller amount is generally more successful. Too large amount will seriously embarrass the heart. A further precaution is necessary as to the manner of injection; force is never necessary and may be very injurious; the blood should be delivered into the vein slowly and gently.

Besides the danger arising from coagulation of the blood and the formation of thrombi, immediate bad symptoms or fatal syncope may come on from the introduction of air into the veins. The utmost care is necessary to exclude air from the apparatus. Phlebitis may also ensue from the injury done to the vein, and the patient's life put in jeopardy from this cause, but this is a danger much more remote than the introduction of air and clots into the circulation.

As a number of successful cases of transfusion (Gesellius, Hasse, and others) have been reported in which lamb's blood was used, the practitioner is now justified in its employment, notwithstanding Landois has shown by experiment that transfusion of mixed blood does injury to the red blood-globules. If lamb's blood is to be used, the animal should be sufficiently anæsthetized to keep it quiet, and it should be securely tied. A vein may be selected, and immediate transfusion performed with Aveling's instrument or with the *aspirateur* in the mode already described.

Transfusion is especially indicated in cases in which life is put in imminent jeopardy by *hæmorrhage.* According to Belina, it is in hæmorrhage from *abortion*, and during the first months of pregnancy, that transfusion is most successful. Of thirteen cases of hæmorrhage from abortion thus treated, according to this author, eleven had a fortunate issue. Of the cases of *post-partum hæmorrhage*—eighty-five in number—in which this expedient was adopted, fifty-six resulted favorably. Routh, Soden, Hicks, McDonnell, Mudge, Howe, and others, have reported successful cases, not included in the statistics of Belina. In other forms of hæmorrhage, *hæmatemesis*, *intestinal hæmorrhage*, *epistaxis*, etc., in which death by exhaustion is imminent, the operation of transfusion is proper. Belina has collected twenty-six cases of *traumatic hæmorrhage*, of which twelve resulted favorably, in two the result was doubtful, and twelve terminated fatally.

Transfusion has also been employed in certain morbid states of the blood, but not with encouraging results. Thus, Belina has collected a number of cases belonging to this category, of which nineteen terminated favorably, in two the result was equivocal, in three temporarily beneficial, and thirty-nine died. Two very interesting cases of the *hæmorrhagic diathesis* successfully treated by transfusion have been reported by Dr. Joseph Buchser, of New York. This form of constitutional cachexia is especially an indication for transfusion. In the treatment of *anæmia* this operation has not been successful. Thus, three cases treated by Stohr, of Würzburg, terminated fatally. Cases have also been reported by Concato, Cavaleri, and others. Transfusion has been used very successfully in cases of carbonic-oxide poisoning (Uterhart, Prof. König, Prof. Martin), and in phosphorus-poisoning (Prof. Jürgensen.)

Eulenburg and Landois advise transfusion in cases of danger to life from poisons for which there are no antidotes. It has been recommended, in such cases, to abstract blood and to supply fresh blood to the suffering organism. Nussbaum has employed transfusion with complete success in *epilepsy*, and it has also been used with favorable results in *eclampsia* due to *uræmic poisoning.*

Arterial Transfusion.—Prof. Albanese has proposed injection of defibrinated blood into an artery, either the radial or posterior tibial, as a substitute for the intra-venous injection. The artery is exposed, punctured, and the blood thrown into it, in the same way as in the operation on the vein. It is claimed for this method that thrombosis is less apt to occur, and that the danger arising from the introduction of air is obviated. When a large amount of blood is necessary, it is more safely introduced by the arterial system, because, having to traverse the capillaries before reaching the right side of the heart, sudden distention of this organ is avoided. Prof. Hüter, who has especially advocated this method, reports a number of cases successfully performed in this way, and Asché has collected a number of others.

Transfusion of Milk.—The experiments of Donné on animals demonstrated the harmlessness of the intra-venous injection of milk. Hodder, of Canada, was the first to employ this expedient on man; and, of three cases of *cholera collapse* which he thus treated, two recovered. Thomas, of New York, has also transfused milk with success in *post-partum hæmorrhage;* and Wagstaff has failed twice with the same method in *traumatic hæmorrhage.* It is in a high degree probable that milk will succeed, quite as well as blood, in the operation of transfusion. The rules governing the operation of transfusion are the same, whatever may be the nature of the fluid injected.

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PART II.

THE ACTIONS AND USES OF REMEDIAL AGENTS.

THOSE USED TO PROMOTE CONSTRUCTIVE METAMORPHOSIS.

ALIMENTS.

THIS extensive subject can, in this work, be considered briefly only, and from the point of view of therapeutics. The various aliments are of the first importance as remedial agents. No satisfactory repair of diseased or wasting tissues can take place without a suitable supply of healthy blood, and healthy blood is the product of proper food and normal digestion and assimilation.

Animal.—One of the most important articles of diet for the sick is *Beef*, and it should be of good quality: the bone should not exceed 20 per cent.; the fat should be firm, not yellow, and free from blood, and should not be in too great proportion relatively; the muscle should be firm without being tough, not too pale, nor dark colored, and should not present any marbling or lividity on cross-section. The most esteemed parts of the beef are the thigh and hip (round, sirloin, fillet), the loin and certain parts of the shoulder (rib roast, porter-house steak, etc.). The composition of beef, according to Moleschott's mean of the Continental analyses, is as follows (Parkes):

Water	73.4
Soluble albumen and hæmatin	2.25
Insoluble albuminous substances	15.2
Gelatinous substances	3.3
Fat	2.87
Extractive matters	1.38
Creatine	0.068
Ash	1.6

The ash contains chlorides of sodium and potassium, potash, soda, lime, magnesia, iron (oxide or phosphate), phosphoric acid, sulphuric, chlorine, and silica. The composition of cooked meat, according to Moleschott (Parkes), is as follows:

Water	54.
Albuminates	27.6
Fats	15.45
Salts	2.95

It will be perceived from the foregoing analyses that beef contains alimentary principles the most important for the nutrition of the body. When of good quality, neither too old nor too young, the fat and muscle suitably proportioned, and not altered by disease, and properly cooked, it is the best of the animal foods.

Veal is less digestible and less nutritious than beef, and has a laxative action, which may, however, be utilized in states of disease. It is more albuminous than fibrinous and abounds in gelatine (Fonssagrives). The thymus gland of the veal (*sweetbread*) is, when "plainly cooked (by boiling) and moderately seasoned, a very agreeable and suitable dish for the convalescent."—(Pereira.)

Mutton, although possessing a lower degree of nutritive value than beef, is one of the most useful of the animal foods, as it is easily digested. Many patients, however, experience a marked degree of repugnance to mutton and cannot be induced to make use of any article of diet containing it. An evident idiosyncrasy exists in some constitutions against it, so that taken disguised in any way it disagrees with the stomach. It does not continue long in favor as the exclusive article of the meat portion of the diet, even with those who relish it for occasional use.

Pork contains more fatty matter and more often disagrees than the meats above described. Many dyspeptics cannot make use of it in any form: on the other hand, breakfast bacon may be much relished and be easily borne. Pork is rarely prescribed as a diet for the sick, but, for convalescents, roasted sucking pig, which is easily digested, may be ordered to vary the food and to stimulate a languid appetite.

Venison is more easily and quickly digested than beef, but does not possess the same nutritive value. It is useful as an occasional article of diet for the state of convalescence and during a course of special animal diet, but for habitual consumption is not equal to beef.

The domestic Chicken is a most important article of food for sick and convalescents. The taste is agreeable, the tissues soft and easy of mastication and digestion. "Spring chickens" are more tender and delicate than the fully-developed fowl of four or six months. Next to the chicken in point of digestibility is the domestic turkey, and after this the domestic goose and duck. Certain "game birds," e. g., the prairie-chicken, wild-ducks, woodcock, snipe, are frequently prescribed for convalescents, and possess a high degree of nutritive value, but are not, of course, adapted for habitual use.

The viscera of certain animals are sometimes employed as food. Allusion has already been made to "sweetbreads," the thymus of the calf. The brain, tongue, heart, liver, kidneys, and alimentary canal, are occasionally eaten, but are not frequently prescribed for the sick. Brain is easily digested, and, as it contains fats in combination with phosphorus, may be usefully prescribed in conditions of disease in which these constituents are presumed to be deficient in amount. Liver, as ordinarily prepared by frying, is very trying to weak stomachs, but this food contains matters which may be utilized in certain diseased states. According to Braconnot (Pereira), the composition of liver is as follows:

Brown oil, containing phosphorus	3.89
Nitrogenous matter	6.07
Albumen	20.19
Salts	1.21
Water	68.64

Kidneys, especially as ordinarily prepared, are very difficult of digestion, and are unsuited for the sick. As they contain a notable quantity of urea and other excrementitious matters, they are for this reason objectionable articles of diet. Tripe, the stomach of ruminants, is very easily digested and very nutritious, when prepared in the simple way, only, which is advisable for invalids. It consists largely of albumen.

In order to test the relative value of the animal foods considered in the foregoing pages, Marchal de Calvi (Fonssagrives) made a series of elaborate examinations to determine the proportion of water and fat to the solid. The results were as follows:

	FIRST ANALYSIS.		SECOND ANALYSIS.	
ANIMAL FOODS.	Solid Matters.	Water.	Solid Matters.	Water.
Pork	294.50	705.50	302.50	697.50
Beef	277.00	723.00	275.00	725.00
Mutton	265.50	734.50	263.50	736.50
Chicken	263.50	736.50	263.00	737.00
Veal	260.00	740.00	255.50	744.50

These analyses assign to pork the first position. In another series of experiments M. Marchal used ether to dissolve the fat contained in the fibres of these meats. His results are expressed in the following figures:

ANIMAL FOODS.	Matters soluble in Ether.	Matters insoluble in Ether.
Beef	25.437	249.563
Chicken	14.070	248.930
Pork	59.743	242.757
Mutton	29.643	233.857
Veal	28.743	226.757

According to these experiments, from the chemical point of view, beef has the highest nutritive value, chicken ranks second, and is but little inferior to beef, while veal is the lowest.

There are certain substances of animal origin which possess great importance as dietetic agents, viz., eggs, and milk and its products.

Eggs.—The following observations refer to the eggs of the domestic chicken. The egg is composed of four distinct parts: the shell; the membranous envelope of the albumen; the white; the *vitellus*, or the yellow. The envelope of the albumen contains nitrogen and sulphur, and phosphate of lime remains after incineration. The white or the albumen contains in 100 parts:

Albumen	12 to 15
Matter not coagulable	5
Water	80

The residue after incineration of the albumen is composed of phosphates and sulphates of lime and magnesia, and alkaline carbonates. The yellow is a phosphorated fatty matter suspended in water by means of an albuminous substance known as *vitelline.* The yellow contains 53.78 parts of water, 17.47 of albumen, and 28.75 of fatty matter. According to Gobley (Fonssagrives, from whom most of these details have been obtained), the yellow has the following chemical constitution:

Water	51.486
Vitelline	15.760
Margarine and oleine	21.304
Cholesterine	0.438
Margaric and oleic acids	7.226
Phospho-glyceric acids	1.200
Sal-ammoniac	0.034
Salts	7.299
Extracts	0.400
Ammonia, nitrogenized matters, coloring matter, lactic acid	0.833

Eggs consumed by the sick should be fresh and sound. The average weight is about two ounces avoirdupois. According to Parkes, the following are tests of the freshness and soundness of eggs:

"Fresh eggs are more transparent in the centre; old ones at the top. Dissolve one ounce of salt in ten ounces of water: good eggs sink, indifferent swim. Bad eggs will float even in pure water." Fonssagrives recommends the same tests. Eggs coated with beeswax dissolved in warm olive-oil (one-third beeswax two-thirds olive-oil) it is said may be preserved for two years.

Eggs raw, or better, whipped, are the most digestible of alimentary substances, and, as their composition indicates, possess a very high degree of nutritive value.

Milk is one of the most important articles of food for the sick, and enters largely into the composition of various diets. It is constituted essentially of four elements—albuminoid, fatty, saccharine, and saline—and therefore contains all the materials necessary for the growth and nutrition of tissues. The nitrogenous constituent is *caseine*, an albuminoid substance, but which differs from ordinary albumen in that it is combined with a larger proportion of alkali, and is not coagulable by heat. The fatty element is *butter*, which contains several neutral fats. The composition of butter is not exactly the same in all kinds of milk the difference being due chiefly to a volatile principle upon which the special taste of each variety depends. The saccharine element is a crystallizable sugar, known as *lactine* or *lactose*, a substance which easily decomposes into lactic acid by a process of fermentation in which the caseine plays the part of a ferment. The mineral constituents of milk are, chlorides of sodium and potassium, phosphates of lime, soda, magnesia and iron. The most important of these is the phosphate of lime. The amount of these salts varies from .5 to .8, and rarely exceeds one per cent. (Parkes). The French commission, appointed by the Prefect of Police of Paris, reported upon the analyses of milk made in various countries, and concluded that the following figures represent the composition of this fluid when of good quality (Tardieu):

Water	87
Total solids	13

	Caseine, Extractive Matters, and Salts.	Butter.	Lactine.
Solids	4.00	4.00	5

The commission fixed the minimum standard of good milk at—

Water	88.50		
Solids	11.50	Caseine, extractives, and salts	4.00
		Butter	2.70 to 3.00
		Lactine	4.50

When perfectly fresh, milk is usually neutral in reaction, or it may be a little alkaline. After a short time—especially in summer—it becomes acid by a process of fermentation in which the lactine is converted into lactic acid, and the caseine coagulates. The fluid portion is called *whey*, and the semi-solid caseine *curds*. By the fermentation of mare's-milk an alcoholic liquor, named *koumiss*, is prepared in Tartary, and has been introduced into medical practice as a remedy for phthisis.

The proportion of cream in good milk ranges from 10 to 15 per cent. by volume. By churning, the fat of the cream is collected and is then known as *butter*. This important article of food has the following composition (Fonssagrives):

Margarine	68
Butyroline	30
Butyrine, caprine, and caproine	2

Butter readily undergoes decomposition—becomes *rancid*—capric and butyric acids separating from the base glycerine. This process is one of fermentation, and is favored by air, light, and imperfect separation of milk in the process of churning. Rancid butter, it need hardly be observed, is not suitable for food.

After the process of churning, which separates the butter, the resultant liquid, known as *buttermilk*, contains the caseine, lactine, and the salts, and is therefore a nutritious article of food.

As the milk of other animals than the cow is sometimes prescribed in medical practice, the comparative chemical constitution of this fluid should be studied. The following table (Pereira) shows at a glance the difference in composition of the milk from several animals:

CONSTITUENTS.	Cow.	Ass.	Goat.	Woman.
Caseine	4.48	1.82	4.02	1.52
Butter	3.13	0.11	3.32	3.55
Lactine	4.77	6.08	5.28	6.50
Salts	0.60	0.34	0.58	0.45
Water	87.02	91.65	86.80	87.98

Whenever fresh and pure milk can be procured, this only should be prescribed for the sick, but in large cities it is not always practicable to obtain it. Under these circumstances " condensed milk " must be used. This preparation is made by evaporation of the water of the milk and the addition of some sugar. It is found in two forms, dependent on the extent to which the abstraction of water is carried: as a granular solid and as a soft semi-solid. The addition of warm water to the condensed milk furnishes a palatable fluid, of the appearance and composition of fresh warm milk.

Fresh milk, boiled and corked up in bottles to exclude the air, will keep for a considerable length of time. To prevent fermentation, some sulphite of lime may be added to it. For temporary preservation of milk in the summer-time, especially when intended for food for infants, a little bicarbonate of soda and sugar may be used.

Cheese contains all the constituents of milk, except the water and some salts and lactine removed by expression. In the preparation of cheese the caseine of the milk is coagulated by *rennet*, the butter and a portion of the lactine and salts are entangled in the meshes of the caseine, and the mass is subjected to powerful compression. The peculiar flavor and quality of the cheese depend upon the nature and richness of the milk, and upon certain fermentative changes which take place, developing volatile, odorous, and sapid constituents. The following table of the composition of cheese illustrates its nutritive qualities:

Water	36.8
Albuminates	33.5
Fats	24.3
Salts	5.4

It is evidently a concentrated food. The digestibility of cheese depends in part on its freshness, in part on its composition. When fresh and of good quality, it does not ordinarily disagree with the stomach. A small quantity of cheese taken after dessert in some cases assists digestion; but many dyspeptics and persons of weak digestion cannot make use of it under any circumstances.

Koumiss.—This is a fluid obtained from mare's-milk by fermentation, and constitutes the principal part of the food of the people inhabiting a portion of Tartary. It contains alcohol, lactic acid, sugar, caseine, fat, salts, carbonic acid, and water. In addition to these constituents, ascertainable by chemical analysis, koumiss contains fragrant compounds, volatile, the product, probably, of the decomposition of the fat and the reaction of the acids on the alcohol, forming ethers. Koumiss of good quality may also be prepared from cow's-milk by the process of fermentation, but, as mare's-milk is more nearly allied to human milk in composition, it is to be preferred in the preparation of this aliment. By variations in the method of preparation, different kinds of koumiss are produced, as, for example, thick koumiss, whey-koumiss, skimmed-koumiss. According to the different stages to which the process of fermentation is carried, there result three degrees of quality, No. 1, No. 2, and No. 3. No. 2 differs from No. 1 in containing more alcohol and carbonic acid, and less sugar and caseine. These constituents, especially the carbonic acid, impart a liveliness to the fluid, so that it effervesces like champagne. In No. 3 the fermentation having proceeded further, butyric, succinic, and acetic acids are produced, and the sparkling quality is enhanced.

Koumiss is prepared from milk, by the addition of a ferment—some koumiss obtained from a previous fermentation or dried koumiss. It is allowed to ferment three days at a temperature of from 70° to 80° Fahr. It is then a bluish-white liquid, having a sharp, acidulous taste, and none of the characteristics of ordinary milk. If heated to 100° Fahr., fermentation is definitely arrested. If before being heated it is bottled, products corresponding to 1, 2, and 3, named above, are the result. Allowed to stand after three days' fermentation, it separates into three layers: the inferior, caseous; the middle, an acid water; and the uppermost, a whitish fluid, the best koumiss. The alcoholic strength is of course determined by the stage of fermentation. The koumiss of two days' fermentation is feeble in strength, and hence the product of three days' fermentation is preferable for medicinal use.

The quantity of koumiss administered depends on the condition of the patient. In cases of feeble digestion, this being the only article of of food, an ounce every hour will be a sufficient quantity. With increased facility in its digestion and assimilation, from a quart to a gallon a day may be taken. When it is used in connection with other food, a tumblerful may be administered after each meal. It is estimated that each quart of koumiss contains four ounces of solid food.

The tolerance of the stomach to koumiss is remarkable, even in cases of gastralgia. It improves the appetite, and excites the action of the kidneys. The patients experience a pleasing exhilaration, due probably to the combined action of the carbonic acid and the alcohol. Decided intoxication undoubtedly may result from the use of a large quantity by any one unaccustomed to it. It also causes somnolence during the day, and favors sleep at night without leaving any after-headache. Its most important action is the increase of the body nutrition; and hence its utility in the treatment of phthisis, indigestion, and the various cachexiæ. Jagielsky says that he has had patients gain as much as ten pounds a month when no other food was taken.

Fish.—A great many varieties of fish are used as foods to which it is necessary to allude in general terms only. Salted fish is not a suitable article of food for the sick: it is difficult of digestion, and possesses but slight nutritive value. Fresh fish, however, properly cooked, is, as a rule, easy of digestion, and furnishes a pabulum of a valuable kind in diseases of certain textures. The following is the composition of fish as compared with beef, according to the analysis of Fr. Schulze:

CONSTITUENTS.	Beef.	Fish.
Fibrine, cellular tissue, nerves, and vessels...............	15	12
Albumen..	4.3	5.2
Alcoholic extract and salts............................	1.3	1
Aqueous extract and salts.............................	1.6	1.7
Phosphates...	traces.	traces.
Fats and loss...	1	"
Water..	77.5	80.1

The commonly-received opinion, that fish is a more highly-phosphorated food than beef, does not receive support in this analysis. White-fish, shad, bass, and fresh mackerel, are more suitable for the sick than cod, salmon, or eels. They should be prepared and eaten as soon as possible after being taken from the water, and should be either broiled or boiled. Only at the time of the ripening of the milt and roe are fish in a suitable condition for the dietary of invalids. At the time of spawning, and immediately after, the flesh of fish is watery and semi-gelatinous.

Oysters rank among the most digestible of foods, and are usually easily borne by the most delicate stomach. According to Fonssagrives the French oyster contains about 12.6 parts of solid matters, consisting of osmazome, chlorides of sodium and magnesium, sulphates of lime and magnesia, fibrine, albumen, and gelatine. They are more easily and quickly digested when eaten raw, or broiled, but stewed is the most common form for use in disease. In cases of great irritability of the stomach, the most easily-borne oyster-soup is prepared by the addition of the liquor to boiling milk.

Vegetable.—The most important members of this class of foods are the cereal grains—wheat, rye, corn, rice, buckwheat, oats, and barley. The universality of its consumption and its nutritive value place wheat-bread in the first position as an article of diet. The composition of wheat-flour is as follows:

Water	14
Fatty matters	1.2
Gluten	12.8
Albumen	1.8
Dextrine, sugar	7.2
Starch	59.7
Cellulose	1.7
Salts (potash, soda, lime, magnesia, phosphoric acid, etc.)	1.6

In the preparation of wheat-flour, the bran is separated. Important constituents of the wheat are thus removed, as the following analysis of the bran shows:

Water	10.3
Fatty matters	2.82
Gluten	10.84
Albumen	1.64
Dextrine, sugar	5.8
Starch	22.62
Cellulose	43.98
Salts	2.52

The internal envelope of the wheat-grain contains also a ferment, known as cerealine, which has very active properties. As the proportion of bran to flour is as sixteen to eighty, it is obvious that considerable loss accrues in the preparation of superfine flour. Wheat-bread made from superfine flour is easy of digestion, owing to its lightness and sponginess permitting a rapid diffusion of the gastric juices through every part of it. Most of it is also available for nutrition; there is little residuum; hence the constipation which attends its use in large proportion relatively to the other constituents of the diet. When flour is unbolted (bran not separated), an increase of nutritive value is obtained, at the expense, however, of digestibility. A large part of the bran, probably, resists the action of the gastric juice, and hence, irritating the mucous membrane, increases by reflex action the secretions and peristaltic movements

Whole wheat-grains, under the name of "*cracked wheat*," is frequently prescribed as an article of diet for invalids. It is boiled until the envelope of the grain is burst open, and is eaten with cream and sugar. Obviously such a combination forms a food of great excellence. The special advantage which it possesses, besides its nutritive value, is its laxative action.

Ordinarily, wheat-bread made of superfine flour is to be preferred for the use of invalids. To obviate the constipating action of such bread, and to obtain a laxative effect, various expedients are adopted. Bran, rye, and corn meal, and, in some kinds of bread, molasses, are added to the dough, forming those varieties known as Graham bread, brown bread, and Boston brown bread.

The important quality of lightness is imparted to wheat-bread by thorough incorporation of carbonic-acid gas with the dough. Two processes are employed for this purpose: By the addition of yeast, fermentation takes place at the expense of a portion of the starch, and carbonic acid and alcohol are produced. By mechanical means, carbonic acid obtained from other sources is mixed with the flour. The latter is known as "aërated bread." Obviously, the mechanical process is more economical because there is no loss of flour. It furnishes usually a lighter and drier bread, and is more easily digested. Bread made by the fermentation process is not unfrequently moist and heavy, and sour, because the fermentation has proceeded beyond the alcoholic stage. "French bread" is lighter, drier, and better baked, than ordinary baker's fermented bread. Warm, fresh bread is not suitable for invalids. It cannot be so perfectly masticated as older bread, and, not reaching the stomach in a state to permit diffusion through the mass of the gastric juices, lies unchanged for hours.

According to Smith, the ultimate composition of wheat-bread is as follows:

Water	37
Starch	47.4
Sugar	3.6
Fat	1.6
Salts	2.3

Macaroni stewed in milk is sometimes prescribed for the sick. Prepared with butter, cheese, and condiments, it is not an appropriate food for invalids. In composition it consists chiefly of gluten, and of course starch—but in less proportion than in bread—and of fat. The cylindrical tubes in which it occurs are formed by passing the paste of flour (gluten) through perforated plates.

Bread requires from three and a half to four hours for complete digestion. Brown bread digests somewhat more slowly.

Barley is but rarely used as food in this country. It is occasionally prescribed for the sick in the form of infusion—a demulcent drink—and is frequently added to soup. It has the following composition (Smith):

Water	15.
Starch	69.4
Sugar	4.9
Fat	2.4
Salts	2.0
Albuminous substances	6.3

Rice is one of the most digestible of vegetable foods, requiring, when boiled, about one hour. Its nutritive value is not equal to wheat, because it consists chiefly of starch. The following is its proximate constitution:

Water	13
Nitrogenous matter	6.3
Starch	79.1
Sugar	0.4
Fat	0.7
Salts	0.5

Rice-water, or decoction of rice, like the corresponding preparation of barley, is used as a demulcent drink in fevers and intestinal disorders. Boiled rice is frequently prescribed as a diet for invalids with weak digestion, and is enriched by the addition of milk and cream, and eggs (rice-pudding).

A comparison of its chemical composition with that of wheat or corn will show that it is by no means equal to them in nutritive value. It is obviously unfitted to sustain life alone, and hence in rice-eating countries it is mixed with fat or other foods supplying principles in which it is deficient.

Corn has the following composition (Letheby, Smith):

Water	14
Nitrogenous matter (albumen)	11
Starch	64.7
Sugar	0.4
Fat	8.1
Salts	1.7

It is not so readily digested as starch, requiring about three hours. Corn, when green, is prepared for the table by boiling, and is eaten with salt and butter, or milk. If young and tender, and sufficiently cooked, it is a digestible and nutritious food; but, if the grain is too mature, it resists the action of the intestinal juices, and passes unchanged.

The mature grain, deprived of the heart and husk, is known as *hominy*. Thus prepared and thoroughly boiled it is an esteemed article of diet, ranking in nutritive value a little above boiled starch. *Mush* is boiled corn-meal, and is eaten with milk, and is sometimes fried.

It is important that mush be well cooked. Corn-meal is also eaten in the form of bread and cakes. These various preparations of corn are liable to cause intestinal disorders, and are hence improper in cases of irritable mucous membrane, and in diarrhœal diseases. For this reason corn-bread is sometimes prescribed in cases of constipation dependent on diminished secretion of the intestinal mucous membrane, and torpor of the muscular layer of the bowel. The starch of corn is not unfrequently prepared for invalids in the form of *blanc-mange*.

Oatmeal corresponds in physical qualities and composition to corn-meal. Its proximate composition, according to Smith, is as follows:

Water	15
Nitrogenous matter	12.6
Starch	58.4
Sugar	5.4
Fat	5.6
Salts	3.0

It is not at all generally used as an article of diet in this country. It is prescribed in the form of gruel as a delicate food. Boiled for a long time, the oatmeal swells up and thickens, forming a *blanc-mange*, which may be eaten with milk, or butter, or cream, and sugar and aromatics.

The Potato, next to wheat, is the most important food derived from the vegetable kingdom. Its composition is affected by its source and variety, and by the soil in which it is grown. The specific gravity of the potato affords an index of its nutritive value, for, the heavier, the greater the quantity of starch it contains. For the sick, watery potatoes are unsuitable. When cooked, the tuber should be mealy and dry. The following is the composition of the potato:

Water	75
Nitrogenous matter	2.1
Starch	18.8
Sugar	3.2
Fat	0.2
Salts	0.7

According to some authorities, the potato contains free citric acid. The salts are rich in potash. According to Letheby, the composition of *sweet-potato* is as follows:

Starch	16
Sugar	10
Albumen	1.5
Gum	1.1
Fat	0.3
Salts	2.9
Water	68.2

These analyses indicate that the sweet potato possesses the higher nutritive value.

Starch, Sago, Arrow-root, and Tapioca, differ from the preceding vegetable foods, in that they contain no nitrogen. They are digested in from one to two hours. They are largely used in the preparation of diets for the sick, but are insufficient in themselves to maintain for any considerable period the vital functions. Hence they are prepared and eaten with sugar, milk, cream, butter, and aromatics.

Turnips, Parsnips, Carrots, Onions, Asparagus, Beets, Cauliflower, and *Cabbages,* are but rarely prescribed for the sick. Nevertheless, some information in regard to their composition and digestibility may not be misplaced. According to Smith, the following represents the composition of

Turnips.		Carrots.		Parsnips.	
Water	91	Water	83	Water	82
Sugar	2.1	Sugar	6.1	Sugar	5.8
Nitrogenous matter	1.2	Nitrogenous matter	1.3	Nitrogenous matter	1.1
Fat	—	Fat	0.2	Fat	0.5
Starch	5.1	Starch	8.4	Starch	9.6
Salts	0.6	Salts	1.0	Salts	1.0

Beets differ from the above chiefly in the quantity of sugar. The following is the analysis of Payen:

Water	83.5	Nitrogenous matter	1.6
Sugar	10.5	Pectose, etc.	0.8
Salts and pecten	3.7		

All of the members of this group are deficient in nutritive value, and are besides slow and difficult of digestion, requiring from three to five hours for complete solution.

Ripe fruits, as grapes, apples, pears, peaches, oranges, lemons, etc., possess but little nutritive value, as they contain only about 10 to 15 per cent. of solid matters. In composition they are represented by sugar, free acid (tartaric, citric, etc.), nitrogenous matters, and salts. They differ, of course, in the peculiar flavoring matters which give to each fruit its special taste. Dried fruits, as dates, figs, and raisins, are relatively much more nutritive, because they contain a larger percentage of sugar. Under the head of dietetic management of diseased states, some further remarks will be made on the use of the fresh and dried fruits.

SPECIAL PLANS OF DIET.

The food-supplies to the organism may be so managed as to secure very definite therapeutical results. By increasing or diminishing the whole amount of foods ingested, by variations in the quality and character of them, and by the employment of some special and restricted methods of feeding, cures are effected not attainable by medicinal treatment.

Denutrition.—The amount of food necessary for bare subsistence has been pretty accurately determined. During the siege of Paris the daily ration was at one time reduced to less than ten ounces of bread and one ounce of meat daily. Dr. Edward Smith ascertained that the daily amount of food barely sufficient to maintain life among the factory operatives must contain 2.84 ounces of nitrogenous matter and 19.25 ounces of carbonaceous. Pettenkofer and Voit give, as the necessary amount of food required by an adult when at work, 5.22 ounces of nitrogenous and 22.38 of carbonaceous matter. Letheby furnishes the following table as the result of his investigations on this point:

Daily Diet for	Nitrogenous, ozs.	Carbonaceous, ozs.
Idleness	2.67	19.61
Ordinary labor	4.56	29.24
Active labor	5.81	34.97

The ration of the United States soldiers imprisoned at Andersonville consisted of one-third pound of bacon and one pound and a quarter of unbolted corn-meal. This amount and quality of food were insufficient to maintain the bodily functions in a healthy state, and hence vast numbers died of scorbutus, diarrhœa and dysentery, and hospital gangrene. From these data we are enabled to form an estimate of the amount and kind of food necessary to maintain life in those cases of disease in which it is desirable to apply the method of denutrition.

Physiological Effects of Insufficient Food.—Intestinal uneasiness, more or less pain, borborygmi, and a feeling of hunger, are among the first symptoms of an insufficient supply of food. The secretions of the intestinal canal diminish, digestion becomes difficult, and constipation results. The respiratory movements are diminished in frequency and volume, and the exhalation of carbonic acid notably declines. According to Dr. Edward Smith, while under an ordinary diet the daily excretion of carbonic acid amounts to thirty-four ounces, under an almost complete abstinence it falls in twenty-four hours to twenty-two ounces. The blood suffers a notable diminution in its amount; the quantity of water augments, and the number of blood-globules greatly diminishes. Meanwhile the blood loses its plasticity, and a tendency to hæmorrhagic extravasations is developed. The urinary secretion also lessens in amount; the urea and uric acid diminish, but the hippuric acid rather increases; the chlorides after some days almost disappear, but the sulphuric and the phosphoric acids persist. As a result of the very obvious decline in the function of assimilation, the temperature of the body falls some degrees below the normal. The functions of the nervous centres undergo a marked derangement. Giddiness, vertigo, hallucinations, ensue, and are coincident with a fatty degeneration of the cells of the gray matter. The subcutaneous fat disappears; the muscles lose a considerable part of their substance. The muscular substance of the heart diminishes proportionally. The bones do not suffer much loss. The extreme degree of loss attainable with safety is from 40 to 50 per cent. of the average weight.

Therapy.—Diminution in the gross amount of aliment and a rearrangement of its constituents are of the first importance in the treatment of *obesity.* The tendency to obesity may be hereditary or acquired. In the former it is cured with difficulty; in the latter a suitable regimen will accomplish much. The fat accumulates under the skin, in the visceral cavities, and in the interstices of organs. Two doctrines have been held by physiologists with regard to the mode of production of fat in the organism: one, that the fat received in the food is simply stored up; the other, that it is also produced by the transformation of some of the other constituents of the food. If the first theory contained the whole truth, it would be necessary only in the treatment of obesity to withdraw from the patient's aliment all fatty substances; but it is found in practice that this is insufficient, and that fat is created out of the starchy and saccharine elements of the food. Hence it is necessary in the treatment of corpulence to interdict not only fats, but the starches and sugar. This was the method of Hippocrates; but it has been revived in our generation by Mr. Banting, and is now usually called *Bantingism.* As a guide to this method of treatment I quote the rules of Mr. Banting:

"For breakfast, at 9 A. M., I take five or six ounces of beef, mutton, kidneys, broiled fish, or cold meat of any kind except pork or veal; a large cup of tea or coffee, without milk or sugar; a little biscuit or one ounce of dry toast; making together six ounces of solid and nine of liquid. For dinner, at 2 P. M., five or six ounces of any fish except salmon, herring, or eels; any meat except pork or veal; any vegetable except potato, parsnip, beet, turnip, or carrot; one ounce of dry toast; fruit out of a pudding not sweetened; any kind of poultry or game, and two or three glasses of good claret, sherry, or madeira—champagne, port, and beer, forbidden; making together ten or twelve ounces solid and ten liquid. For tea, at 6 P. M., two or three ounces of cooked fruit, a rusk or two, and a cup of tea without milk or sugar; making together two to four ounces solid and nine liquid. For supper, at 9 P. M., three or four ounces of meat or fish, similar to dinner, with a glass or two of claret or sherry and water, making together four ounces solid and seven liquid."

Sugar, Mr. Banting finds, is one of the most active of fat-forming foods. His method consists in the avoidance of sugar, fat, and farinaceous substances—in fact, all roots or vegetables grown underground. Although this system was pursued by Mr. Banting with success, it cannot always be persisted in without danger. The dietary is wanting in the amount both of carbonaceous and nitrogenous constituents necessary to the healthy action of the organism. Therapeutically it is adapted to the end in view—the denutrition of the body; but it is, physiologically considered, unsafe to be long persisted in, because insufficient for the work of the body.

Aneurism.—A low diet, with absolute rest, is of great value in the treatment of internal aneurisms. The diet should be only sufficient to maintain life. The method of Valsalva consisted in such a diet and frequent and free bleedings, with rest. The low diet, rest, the hypodermic injection of ergotine, and the internal administration of full doses of the iodide of potassium, are the measures now resorted to for the relief and cure of aneurisms so situated as to be beyond the reach of surgical treatment.

To diminish the Volume of the Fœtus in cases of Dystocia has been suggested by Merriman, Baudelocque, and Moreau, and was successfully practised in two cases by Depaul. The method consists in free abstraction of blood, and the lowest diet consistent with the existence of life. At the present time the methods of inducing premature labor have been so perfected as to quite take the place of the practice of Depaul.

Syphilis.—It is certainly an eminently rational expedient to relieve the organism of a virus by a continuous and gradual molecular destruction and a renewal of the anatomical elements. Such is the hunger-cure of syphilis, an Arabic method of treating that disease. Very satisfactory results have been attained by this means; but the self-denial and even suffering which it requires render it exceedingly unpopular with patients.

DRY DIET.—This consists in a decided diminution or a temporary total suspension of liquid of all kinds. It is well known that water constitutes about two-thirds of the gross weight of the adult body. The quantity of water daily lost from the body has been estimated at about four and a half pounds. Dalton thinks that fifty-two fluid-ounces is the quantity required by a man in full health exercising in the open air. The difference between this and the amount of loss is made up by the water contained in food, especially in the succulent vegetables. Indeed, it is quite possible for the vegetarian, whose diet consists of fruits and vegetables, to receive sufficient water in this way for the purposes of his organism.

Physiological Effects of Dry Diet.—Besides the tormenting sensation of thirst, the food is swallowed with difficulty and the appetite is lost. Absorption of the interstitial fluids takes place, and the volume of the organs undergoes diminution. The subcutaneous veins flatten, and the pulse loses in tension and amplitude; the saliva becomes viscid; the urine reddens and deposits a sediment; constipation ensues, and a rapid emaciation takes place (Fonssagrives).

Therapy.—As the withdrawal or decided diminution of fluid causes rapid absorption of the interstitial water, this method of treatment may be resorted to with advantage in cases of *dropsy.* It has been used with success in dropsical accumulations of the serous cavities, and is adapted to the treatment of *hydrothorax, hydrops pericardii,* and *ascites.*

Fonssagrives reports two cases of *diabetes insipidus* (polyuria) decidedly benefited by the dry diet. This method of treatment is indicated in the first stage of fibroid kidney, in which disease the thirst is excessive, the stomach rather intolerant of fluid, and the flow of watery urine excessive.

Dilatation of the Stomach, besides other appropriate treatment, is benefited by water-free food. That form of dyspepsia and dilatation of the stomach produced by excessive beer-drinking is much improved by abstinence from drinks of all kinds. *The ice-water dyspepsia,* a malady quite common during the summer months of this country, may be entirely relieved by dry diet.

VEGETABLE DIET.—The special indications for the use of vegetable food are reserved for the sections on diet in special diseases. It is necessary, however, to say something here of the *grape-cure,* a method of treatment much in vogue in some parts of France and Germany.

The *grape-cure* consists, according to Carrière, of a diet exclusively of grapes. They are taken many times a day to repletion. It is usual to commence with a pound, and progressively to increase the amount to two, three, six, and eight pounds, a limit which is not exceeded. The first grape-repast, which may be the most abundant, is in the early morning, but not as are the others, eaten in the vineyard. Another is taken at the time of the morning meal (corresponding to our breakfast); the next after the morning walk at the time of the *déjeuner* (noon), consisting of bread and water; another before the usual dinner-hour (evening), and finally before retiring. The treatment is continued during the five or six weeks of the duration of the grape-crop.

The grape-cure is used with success in *plethora of the portal circulation, diarrhœa, dysentery, hæmorrhoids,* and *engorgement of the spleen.* It renders much service in the principal dyscrasiæ, as *scrofula, tuberculosis,* and *phthisis, gout,* and *cutaneous diseases* (Carrière). The influence of change of air, of new scenery, and of the hygienic rules enforced at these resorts, should not be ignored in an estimate of the value of this method.

The composition of the ripe grape is, according to Smith, as follows:

Soluble.		Insoluble.	
Grape-sugar	13.8	Skins, stones, etc.	2.6
Tartaric acid	1.12	Pectose	.9
Nitrogenous matter	.8	Mineral matter	.12
Gum, fat, etc.	.5		
Salts	.36		
Water	79.8		

The quantity of nitrogenous matter is insufficient for the needs of the organism, hence the addition of bread and water to the diet of the grape-cure.

Animal Diet.—The more or less exclusive use of animal food improves the quality of the blood by increasing the number of the red corpuscles. The urine rises in specific gravity, and the urea and uric acid are increased in amount. According to Liebig, force in excess is developed from a diet of animal food, whence a nation of animal feeders must be a nation of hunters, possessing a savage disposition. Those who consume largely of animal food are not fat, but have a high degree of muscular activity. They are tormented by imperious venereal desires, and are irritable in temper.

Therapy.—A diet of animal food is specially indicated and of great utility in *diabetes.* As the vegetables and fruits contain sugar, and starch which is readily transformed into sugar, they are interdicted in this disease. A method of treating *diarrhœa* long practised in Russia, and popularized by Trousseau, consists in the use of a pulp of raw meat. A bit of filet of beef is deprived of all fat and aponeurotic fibre, minutely divided, and beaten in a mortar until all traces of fibres have disappeared. It is then pressed through a fine sieve and mixed with sugar, conserve of roses, or suitable aromatics, or seasoned with salt and pepper to the taste. It may be administered in this form with fruit-jelly, or spread on thin pieces of bread. A beefsteak hastily broiled on a hot fire, so as to retain its juices, may be treated by the same method, or the raw beef scraped to a pulp, rejecting the fibre, may be thrown on to a hot skillet for a few seconds to give an odor and appearance of cooked meat. This method, which has been used especially in the treatment of diarrhœal diseases of early life, is equally efficacious in the *chronic diarrhœa* of adults. The chief objection to this mode of alimentation is the great frequency with which tape-worm follows.

In states of debility arising from any cause in which it is necessary to supply an easily-digested nitrogenous aliment, raw beef may be used in this way.

Blood is so rich in the elements of nutrition that its employment as a food in wasting diseases need not excite surprise. Within a few years it has been much used in the treatment of *phthisis*, the patients resorting to the butchers' shambles to quaff the blood as it flows away. On the part of the patients, it is supposed to possess some special curative power; but it is only as a nutrient that its use is justifiable. Besides the unpleasant associations which must necessarily be connected with blood-drinking, there is danger of swallowing parasites. That it improves nutrition, often to a remarkable extent, is undeniable. It must therefore remain a question to be decided by the patient whether he will incur the risk of infection by parasites, to be benefited by drinking a valuable nutrient.

As the serum of the blood contains the most important of the nutritive elements of the blood, the use of this has been proposed in lieu of the latter, administering one ounce three times a day. Blood-serum is said to be an efficient vermifuge. It must be taken fasting.

Milk-Diet.—The numerous and important applications of milk-diet in the treatment of certain forms of disease render it necessary to devote considerable space to the consideration of this subject. Milk is a food already prepared, and therefore needs no intervention of unskillful cooks; it can be obtained everywhere; few patients are disinclined to take it.

Physiological Effects of Milk-Diet.—In the use of a diet for a long time exclusively of milk, great difficulty is often experienced in overcoming the repugnance of the patient. Although as a rule it is taken with readiness at first, after a time it begins to pall upon the appetite, and the greatest resolution is necessary on the part of the patient in order to continue it. A distressing sense of emptiness is experienced at the epigastrium. The mouth becomes pasty, and the tongue is coated with a thick, whitish fur. Constipation, sometimes exceedingly obstinate, occurs, and the stools are hard and of an ochre-yellow color. Occasionally diarrhœa is produced, but this is due to the fact that the milk disagrees and is not digested. The urinary secretion is increased in amount, but this is due simply to an increased flow of water. Although milk contains all the constituents necessary for the nutrition of the body, when it is used as an exclusive article of diet in the case of those accustomed to a full mixed diet, a decided diminution in the weight of the body takes place. After a time, however, the waste ceases, and the weight continues at a uniform level. The interference of a milk-diet with nutrition is more decided when skimmed-milk is used—a form in which it is more usually administered in intestinal disorders. The pulse is quickened and the arterial tension lowered; but a fall in the pulse-rate takes place when the body ceases to lose weight. A marked degree of debility is experienced by some persons, so that they are unable to take exercise. In two cases in which I used this method with signal success—chronic eczema, and chronic ulcer of the stomach—the patients, both females, experienced vertigo and faintness, and Mitchell mentions a case in which from the same cause he was compelled to discontinue the milk. Ordinarily, however, nothing more than weakness is experienced.

Therapy.—Pecholier, Carel, Mitchell, and all who have treated of the milk-cure, insist upon the suspension of all other food and drink. The quantity to be taken will vary with the constitutional peculiarities, habits of life, and probably the mental condition of the patient. As milk requires about three hours for its complete digestion, this furnishes a rule for its administration. One gill, or four ounces, every three hours, beginning on rising in the morning, is the rule which I have followed with success. As soon as the patient can take a sufficient quantity, one or two tumblerfuls four times a day may be ordered, From a quart to two quarts is the daily amount which will be taken usually by the patient. It is better administered slightly warm.

In many cases of stomach and intestinal disorders, it is better to give skimmed-milk. The milk should stand for twenty-four hours in a cool place, and then all the cream which has risen should be carefully removed. Sometimes, says Pecholier, when crude milk disagrees with or is disgusting to the patient, it may be boiled. The digestion of the milk, says the same authority, when it is poorly borne, may be aided by the addition of lime-water, bicarbonate of soda, and other alkalies. Mitchell has added lime-water for the first few days under the same circumstances, and, in order to overcome the patient's repugnance to the taste, has faintly flavored the milk with a little coffee or caramel; but he prefers to give it alone as soon as possible. My own observation has been, that milk is better borne when given for the first few days with lime-water, in proportion of one-fourth of the latter.

For the *nourishment of infants* deprived of their natural food, no substitute is better than cow's-milk diluted with about one-third of water and sweetened with sugar, in order more closely to assimilate it in composition to the human milk. This should be given at a temperature of 100° Fahr., and at intervals of three hours. No other food than milk is proper for infants up to the eighth month of life, for their digestive organs are not adapted to the digestion of the farinaceous foods so commonly supplied them. If the milk be rejected, the addition of lime-water may enable the infant to retain and digest it.

In the treatment of disease in the adult with skimmed-milk, the time for suspension of the diet depends on several conditions. Carel begins to make additions after two or three weeks; Pecholier when the effects sought for in the treatment are obtained. Mitchell formulates his method as follows: "My own rule, founded on considerable experience, is this: Dating from the time when the patient begins to take milk alone, I wish three weeks to elapse before any thing be used save milk. After the first week of the period, I direct that the milk be taken in just as large amount as the person desires, but *not allowing it to fall below a limit which, for me, is determined in each case by his ceasing to lose weight.* Twenty-one days of absolute milk-diet having passed, with such exception as I shall presently mention, I now give a thin slice of stale white bread thrice a day. After another week, I allow rice once a day—about two tablespoonfuls—or a little arrow-root, or both, as circumstances may dictate. At the fifth week I give a chop once a day; and, in a day or two, another at breakfast; and after the sixth week I expect to return gradually to a diet which should still consist largely of milk for some months." My own rule has consisted in the gradual addition of other diet after the cessation of symptoms for which the milk-treatment was instituted.

To overcome the obstinate constipation which sometimes attends the milk-cure, a variety of measures have been proposed. Carel advises coffee in the morning. Mitchell recommends a half-grain of aloes at night, and Saratoga-water in the morning. I find that fifteen drops of the tincture of physostigma at night will often succeed, but more frequently prescribe with success a teaspoonful of Epsom salts dissolved in a half-tumberful of ice-water to be taken on rising.

The milk-cure is especially adapted to the treatment of obstinate stomach-affections. It has succeeded admirably in the treatment of *dyspepsia*, *gastric catarrh*, *gastralgia*, *gastric ulcer*, and has procured marked amelioration in cases of scirrhus of the stomach. In *chronic intestinal indigestion*, obstinate and persistent *enteralgia*, *chronic diarrhœa* and *dysentery*, it has proved very efficacious.

The treatment of *ascites* by a milk-diet appears to have been of ancient origin, for Hippocrates distinctly refers to it, but the revival of the practice in modern times is due to Chrestian, of Montpellier, who demonstrated the utility of this practice in a number of cases (Fonssagrives). Pecholier and Chairon also report cases of success treated by this method. In cases of ascites the result appears to be due to the profuse alvine and urinary discharges which are caused by the milk-diet in this disease. Pecholier also reports cases of general anasarca due to cardiac disease, much benefited by this treatment. In England, Donkin has issued a monograph on the skim-milk treatment of *albuminuria*, with successful cases. This method has also been extended to *diabetes*, and reports of cures are not wanting.

Eczema, connected with acid indigestion, has been successfully treated by an exclusive skim-milk diet in my hands, and Mitchell reports an analogous case. *Gout* and *gouty affections* have also been much improved, and the diathesis apparently removed, by a persistent use of the milk-cure. Lastly, *aneurism* and *cardiac disease* (irregular and tumultuous action due to valvular lesions) have been benefited by a *milk-regimen*.

WHEY-CURE.—This mode of treatment is conducted in the mountain health-resorts of Switzerland and Germany, and is usually connected with the grape-cure. As whey contains so little of the nutritious elements of the milk, we may conclude with Lebert that the hygiene and climate of these mountain-resorts do everything for the patients, and if they improve they do so in spite of the whey.

KOUMISS-CURE.—Koumiss differs from whey in containing the nutritive constituents of milk, and from milk itself in the important respect that it is in addition an effervescing alcoholic fluid. Koumiss possesses great value in the treatment of *phthisis*, *chronic bronchitis*, *the low stage of fevers*, *the stage of convalescence from acute diseases*, and in fact in all adynamic states in which the combined effect of alcohol and nutrients may be desirable.

Buttermilk-Cure.—To the efforts of Dr. Ballot, of Rotterdam, is due the knowledge we now possess of the value of buttermilk as a food for infants. The relative composition of buttermilk and mother's-milk is given in the following table:

CONSTITUENTS.	Buttermilk.	Mother's-Milk.
Caseine	43.8	34.3
Milk-sugar	23.6	48.2
Butter	2.0	23.3
Salts	5.6	2.3
Water	921.75	883.6
Total solids	78.25	116.4
Lactic acid	2.75	nil.

It is probably in consequence of the presence of lactic acid, as Dr. Ballot suggests, that buttermilk is easily digested. His manner of preparing the food for infants is as follows: To a pint of buttermilk is added a spoonful of wheat-flour. This is boiled a few minutes. The pap must be thin. To this quantity of buttermilk, after it is boiled, is added half a drachm of sugar. It should have a sweet taste.

In the beginning some teaspoonfuls are given to habituate the infant to the smell and taste, but as soon as possible it should be administered in a nursing-bottle. The temperature should be about 96° Fahr. When the infant acquires a taste for the preparation, it may be given *ad libitum* twice a day.

Buttermilk-cure may be substituted for the milk-cure in cases of *stomach-disease*, in which the former has proved so successful, and in cases of *albuminuria* and *diabetes*. In consequence of the large proportion of lactic acid which it contains, buttermilk is more especially indicated in diabetes.

Infant-Feeding.—It has already been stated that fresh milk of the cow is the best substitute for the mother's-milk. Some additional observations as to the management of cow's-milk, and as to the substitutes therefor, may, however, be necessary. There can be no doubt that cow's-milk is better than goats' or asses', as a rule, although there are infants who thrive on the two last-named better. In the large cities where it is impossible to procure fresh milk, condensed milk is an efficient substitute. As in the preparation of this the temperature is raised to near the boiling-point of water, it undergoes no change, and can be used when fresh milk is not to be procured, or cannot be preserved. Condensed milk is ready for use by mixing it with water in the proportion of one teaspoonful of milk to seven of warm water. When the addition of lime-water is desirable, it can be added in proper proportion. In the author's experience, children, with few exceptions, do well on condensed milk.

Caseine is that constituent of milk which is most likely to disagree with infants. Dilution with water, lime-water, barley-water, etc., is not unfrequently effective in securing the digestion and absorption of the caseine; but some infants are unable to digest it at all. Various expedients are resorted to when the caseine fails entirely of digestion. Cream diluted with barley-water sometimes succeeds extremely well. The indigestion of the caseine of a given specimen of milk may be due to an insufficient quantity of cream; this defect can be obviated by adding it artificially. When the infant is not nourished sufficiently, and yet does not pass undigested caseine, the proportion of cream is probably too low. To assist the digestion of caseine, Jacobi recommends that a little well-sweetened oatmeal-gruel be given the infant before taking the bottle, or be mixed with the milk. His method of preparing the food is as follows:

"A teaspoonful of either oatmeal or barley is boiled in from three to six ounces of water, with some salt, for twelve or fifteen minutes, the decoction to be quite thin for very young infants, thicker for later months, and then strained through a linen cloth. Infants of four or six months are to have equal parts of this decoction, which ought to be made fresh for every meal; and boiled and skimmed cow's-milk and sugar are to be added. At an early age, the thin decoction; at a later, the milk ought to prevail in the mixture, which ought to be given at a temperature of 80° to 90°; ought to be neutralized, when acid, with a few grains of bicarbonate, or carbonate of potassa or soda, and, until infants are eight or ten months old, thin enough to be taken through a nursing-bottle."

Various substitutes have been proposed for cow's-milk; but they are at best constructed on doubtful principles, and vary greatly in composition. Liebig's preparation has had the greatest celebrity, because of the reputation of its inventor, rather than of its intrinsic merit. It is prepared as follows: An ounce of wheaten flour is mixed with ten ounces of milk; it is then boiled for ten minutes, removed from the fire, and allowed to cool to 90° Fahr. An ounce of malt-powder containing fifteen grains of potassium bicarbonate, and two ounces of water, are then stirred into it, and the vessel, covered, stands for an hour and a half at a temperature of 100° Fahr. It is boiled for a few minutes again, and then strained, when it is ready for use. The object of the malt is to transform the starch into glucose.

Chambers recommends the following when the artificial feeding of the infant begins: "Cow's-milk should at first be mixed with half its bulk of soft, pure, tepid water, in each pint of which has been suspended a drachm of sugar-of-milk, and two grains of phosphate of lime, finely-powdered. If the milk has been partially skimmed, as is often the case in cities, then a tablespoonful of cream should be added to each pint." Smith, whose authority in questions of infant therapeutics is admitted, also advises the addition of cream to ordinary cow's-milk, and carbonate of potassa or lime-water. At the expiration of six months the milk should be given undiluted. An infant's food should always be raised to the temperature of 95° Fahr. Regularity in the time of feeding is of very great importance: for the first six weeks, every two hours, and subsequently, every three hours.

ALIMENTATION IN DISEASES.

ALIMENT IN ACUTE INFLAMMATIONS AND FEVERS.—The febrile state induces serious changes in the constitution of solids and liquids. The interstitial fat disappears from the tissues, which become soft and watery. The muscles become flabby and pale, and decline in contractile energy. Digestion is feeble, or suspended, or abnormal, and the food supplied is either rejected or enters the blood in an imperfectly-prepared state. The blood suffers material alterations; the red corpuscles diminish in number; the fibrine increases, and the products of imperfect tissue-metamorphosis accumulate. The urine is usually scanty, and high-colored, and loaded with uric acid and urates. The chlorides more or less diminish in or disappear from the urine, but accumulate in the inflamed tissues. The excretion of phosphates is increased. In the tissues, the seat of organic alterations, rapid but imperfect metamorphosis ensues, and on the one side pathological materials crowd the interstices in the anatomical elements, and on the other the products of waste struggle for elimination. Avoiding further speculation as to the fever-process, it will suffice to state that an enormous increase of the urea-discharge takes place, and that the organs and tissues of the body undergo a granular disintegration, which has been designated "parenchymatous degeneration;" or, as it may be stated, the increased temperature of fever represents an enormous consumption of the nitrogenous elements. The higher the range of temperature, as a rule, the more extensive the parenchymatous degeneration.

In *fevers* and *inflammations* not of the digestive tract, the most useful aliments are milk and beef-tea. These should be given at intervals determined by their rate of digestibility, usually about every three hours. Fresh milk only should be used, and, if the stomach be irritable, it may be diluted with one-half to one-fourth of lime-water. It has been conclusively demonstrated that fresh milk is the most suitable aliment in *typhoid*, and it may be depended on wholly (Johnson). It is equally applicable as the aliment in *scarlatina*, partly as a nutrient, and partly as a diuretic, for in this disease one of the chief dangers is from arrest of the urinary secretion.

The author is convinced that beef-tea and beef-essence are too exclusively used in the treatment of the fevers and inflammatory diseases. As an aliment, beef-tea is much inferior to milk, and it is also more difficult of digestion. It is not unusual to see, in cases of typhoid, the beef-tea floating on the peculiar dejections of this disease. It ought, therefore, never be used as the exclusive aliment in typhoid cases. Another fallacy of a very dangerous kind is current in domestic practice, viz., the belief that beef-tea, which gelatinizes on cooling, is especially rich in nutritive elements. Such beef-tea consists chiefly of gelatine, which has very little value as a nutrient.

FORMULÆ FOR ANIMAL BROTHS.

"*Beef-tea.*—A pound of lean beef should be freed from fat, tendon, cartilage, bone, and vessels; it must be chopped up fine, and put in a pint of cold water to digest for two hours. It should simmer on the range or stove for three hours, but the temperature should not exceed 160° Fahr. The water lost by evaporation should be made up by the addition of cold water, so that a pint of beef-tea should represent one pound of beef. It should be strained, the beef being carefully expressed. A wineglassful every three hours is a suitable quantity for administration in ordinary acute cases.

"*Mutton-Broth.*—Lean loin of mutton, one pound, exclusive of bone; water, three pints. Boil very gently till tender, throwing in a little salt and onion according to taste. Pour out the broth into a basin, and, when it is cold, skim off all the fat. It can be warmed up as wanted.

"*Chicken-Broth.*—Skin, and chop up small, a small chicken, or half a large fowl, and boil it, bones and all, with a blade of mace, a sprig of parsley, and a crust of bread, in a quart of water, for an hour, skimming it from time to time. Strain it through a coarse cullender."

The digestibility of these animal broths is improved by the addition of pepsin and muriatic or lactic acids. Beef-essence, obtained by pounding finely-divided beef in a mortar until the nutritive elements are separated from the fibre, may be administered instead of the broths above described. Essence of this kind may be mixed with sherry or other wines, whiskey, or brandy, provided alcoholic stimulants be also indicated.

FORMULÆ FOR DIET-DRINKS.

"*Wine-Whey.*—Put two pints of new milk in a saucepan, and stir it over a clear fire till it is nearly boiling; then add a gill of sherry, and simmer for a quarter of an hour, skimming off the curd as it rises. Then add a tablespoonful more sherry, and skim again for a few minutes.

"*Flaxseed-tea.*—Flaxseed, whole, one ounce; white sugar, one ounce; liquorice-root, half an ounce; lemon-juice, four tablespoonfuls. Pour on these materials two pints of boiling water; let them stand in a hot place four hours, and then strain off the liquor.

Barley-Water.—Wash two ounces of pearl barley with cold water. Then boil it for five minutes in some fresh water, and throw both waters away. Then pour on two quarts of boiling water, and boil it down to a quart. Flavor with thinly-cut lemon-rind, and sugar to the taste; but do not strain unless at the patient's request.

Other foods frequently prescribed for the inflammatory and febrile states are wine-whey and "egg-nogg," or "egg-flip." To a pint of boiling milk add four ounces of sherry; strain and sweeten the whey to the taste. This is a grateful subacid drink, but slightly nutritive. Egg-nogg may be prepared as follows: "Scald some new milk by putting it, contained in a jug, into a saucepan of boiling water, *but it must not be allowed to boil.* When quite cold, beat up a fresh egg with a fork in a tumbler with some sugar; beat quite to a froth, add a dessert-spoonful of brandy, and fill up the tumbler with scalded milk." This may be used in alternation with beef-tea, or exclusively in acute inflammatory or febrile affections, but the interval of its administration should not be shorter than three hours. Milk and egg may be served separately with wine or brandy, as follows: "To one tablespoonful of brandy, or one wineglassful of sherry, in a bowl or cup, add powdered sugar and a very little nutmeg to taste. Warm a breakfast-cup full of new milk and pour it into a spouted jug. Pour the contents from a height over the sugar, wine, etc. *The milk must not boil.*"

"Beat up with a fork an egg till it froths; add a lump of sugar and two tablespoonfuls of water; mix well, pour in a wineglass of sherry, and serve before it gets flat. Half the quantity of brandy may be used instead of sherry."

The foregoing are the most accessible and the most nutritious aliments for the acute stage of fevers and inflammations. They contain the materials necessary to supply the loss taking place in the organism at large, and to repair the damage to tissues in the state of inflammation.

ALIMENTS IN DISEASES OF THE DIGESTIVE ORGANS.—In acute and chronic affections of the digestive organs, especially the latter, the skim-milk treatment, already described, possesses the highest value. When the trouble is localized to the stomach and is of an acute character, only the most easily-digested aliments are borne, as, for example, milk and lime-water, barley-water, tamarind-whey, carbonic-acid water, effervescent lemonade, etc. The following formulæ are useful:

"To a tablespoonful of pearl-barley, washed in cold water, add two or three lumps of sugar, the rind of one lemon, and the juice of half a lemon. On these pour a quart of boiling water and let it stand for seven or eight hours. Strain it."

"Boil an ounce of tamarind-pulp with a pint of milk, and strain."

"Squeeze two large lemons, and add a pint of spring or cistern water to the juice and three or four lumps of white sugar. When required for use, pour half of it into a tumbler, and add half a small teaspoonful of carbonate of soda; stir and drink while effervescing."

In the *chronic affections of the stomach*, when digestion is feeble, especially of the nitrogeneous elements (deficiency of gastric juice), such aliments as boiled rice, tapioca, arrow-root, unfermented bread (aërated bread), and the farinaceous vegetables, are indicated, for these foods are digested chiefly in the small intestine. Cases of acidity and heart-burn, dependent on the fermentation of the starchy and fatty elements of the food, require abstinence from the articles containing them.

The acid fruits and vegetables (apples, peaches, tomatoes, etc.), are to be preferred under such circumstances to the farinaceous foods. An acid wine (Rhenish or Catawba), taken at the principal meal, will often correct the acidity derived from the fermentation of starch and fat.

In *intestinal indigestion, summer diarrhœa, and cholera infantum*, it is necessary to supply those foods which undergo solution in the stomach, in compliance with the fundamental therapeutical principle of giving a suffering organ (the intestine) rest. Starches and fats should therefore be withheld. Bread, arrow-root, potato, beans, peas, butter, and other fats, increase the disease, because on reaching the affected organ they are not finally digested, but act as irritants. This result is well seen in the summer diarrhœa of infants. Milk, eggs, animal broths, broiled or raw beefsteak, oysters, white-fish, are suitable aliments under these circumstances. Similar rules obtain in the treatment of *jaundice from catarrh of the gall-ducts* and of *biliary concretions*. The starches and fats are especially active in setting up those local disturbances which result in the production of jaundice by extension of the catarrhal process from the duodenum along the hepatic duct. The use of fat and oil has an immediate result in favoring the crystallization of the cholesterine, or in causing inspissation of the bile.

Cases of *chronic diarrhœa* are sometimes remarkably benefited by a diet of grape-juice, peaches, and such succulent vegetables as tomato, celery, and raw cabbage. It is probable that the cases so benefited are really scorbutic in character. The author has known many obstinate cases of summer diarrhœa of infants to be improved by the addition of ripe peaches to the milk-diet.

A proper regulation of the diet is of great importance in the treatment of *habitual constipation*. This usually depends on deficient secretion, or torpor (a paretic state) of the muscular layer of the intestines. Corn-bread, cracked wheat, oatmeal, bread of unbolted flour, fruits, and such vegetables as green corn, tomatoes, and celery, are indicated. Those troubled with habitual constipation, to a moderate extent, may overcome it by the daily use at dessert of a few almonds and raisins, about six of each. Hæmorrhoids due to congestion of the portal vein, or to constipation, is much benefited by the grape-cure, or a diet of fruits and succulent vegetables.

Aliment in Cachectic States.—To store up fat in the tissues and to increase muscular power, the diet must consist of both nitrogenous and carbonaceous elements. The fats themselves hold the first place as fat-forming foods. Those most frequently employed for this purpose are the fat of meat, butter, olive-oil, cream, and milk. Sugar and saccharine fruits and vegetables rank next in importance as fat-formers. The organism has the power of transforming starch into fat, whence bread, potato, pastry, rice, arrow-root, etc., belong to this class. The malt liquors undoubtedly possess an extraordinary energy in the same direction, hence the use of beer and ale by nursing-women; but it is undoubtedly true that milk is better for increasing the production of milk. Less force is lost in the conversion of cow's-milk into human milk than in the complex process needed for transforming the nutritive elements of malt liquor. The same fact is true in regard to the relative facility of the appropriation of fatty aliment and of the conversion of saccharine and farinaceous food into fat. It is also true that, for the increase of muscular power, muscular tissues and juices are more easily applied by the organism.

In the *scrofulous*, *mercurial*, *plumbic*, *syphilitic*, and *paludal* cachexiæ, and in *phthisis*, a combination of the flesh and fat-forming foods is necessary. The hunger or *denutrition* cure, as already explained, may be applied to the treatment of these cachexiæ, the object being to produce such waste and molecular changes as to cause the elimination of the morbific matters. On the other hand, the object sought to be accomplished in these states of disease and in phthisis, by improving the body nutrition, is to supplant by fresh material the lesions of the anatomical elements.

In *rickets* (*mollities ossium*) it is necessary to supply a food rich in phosphate of lime and other phosphate salts. Oatmeal, bread of unbolted flour, cracked wheat, etc., should be added to the dietary.

Gout, *rheumatism*, and the so-called *uric acid diathesis*, require a diet composed chiefly of farinaceous vegetables and acid fruits. Animal food and saccharine substances are contraindicated in these disorders.

In no disease is the influence of diet more conspicuous for good or evil than in *diabetes*. I have already alluded to the milk-cure, revived by the Montpellier school and popularized in England by Dr. Donkin. All saccharine substances and fruits and vegetables containing them, and all farinaceous foods the starch of which is easily convertible into dextrine and sugar, are injurious in diabetes. In this prohibition are included bread, potato, beets, beans, peas, sugar, milk, pastry, and sweetmeats of all kinds. Tomatoes, celery, and raw cabbage, are not objectionable. In order to compensate for the loss of bread, the greatest deprivation endured by these diabetics, gluten and almond bread are now prepared. To supply the deficiency in the alimentation of diabetics caused by the withdrawal of the starch elements of the food, fats must be used, as butter, olive and cod-liver oils, fat of meat, cream, etc.

NUTRIENT ENEMATA.—It not unfrequently happens that the stomach will not receive and dispose of nutrient materials, when it becomes necessary to employ nutrient rectal injections. It has been proposed to treat *ulcer of the stomach* by absolute rest of the organ and the introduction of foods by the rectum. In cases of excessive *irritability of the stomach* the same practice is sometimes necessary. *Œsophagotomy* and *gastrotomy*, as also *wounds of the stomach*, may render the use of nutrient enemata indispensable to save life. It should not be forgotten that the rectum is not an organ of digestion; hence nutrient enemata must contain the materials for artificial digestion. Furthermore, the mucus and fluids of the rectum are alkaline in reaction. To secure rapid osmosis, therefore, the enemata should have an acid reaction. The following formula is suitable for the purpose:

Beef-tea, prepared as before described, four ounces; hydrochloric acid, ten minims; glycerole of pepsin (Scheffer's), two drachms.

If the rectum is irritable, ten to twenty drops of the tincture of opium may be added to the injection. If stimulants are indicated, brandy may also be added. The rectum soon becomes intolerant of injections; hence, the greatest care should be used in practising them, to avoid sudden distention of the bowel, and frequent introduction of nutrient materials should be avoided. Five times in the twenty-four hours should be the maximum—for artificial digestion is much slower than normal stomach digestion.

Aliment in Diseases of the Skin.—Two general principles underlie the alimentary treatment of skin-diseases: to depurate in the case of the overfed; to supply better and more suitable nutrients to the underfed. A very influential factor in many cases of skin-disease is dyspepsia. The denutrition-cure, as applied in the skimmed-milk treatment, often produces a marvelous change in the condition of the skin in such cases. Acid dyspepsia, due to the acid fermentation of the starchy, saccharine, and fat elements of the food, requires the withdrawal of the substances containing them. The pale, anæmic subjects of skin-diseases require a combination of the nitrogenous and carbonaceous elements—especially the oils and fats—to put their tissues in a condition to resist the extension and perpetuation of the local morbid action.

BEVERAGES.

Coffee.—*The seed of caffea Arabica; café*, Fr.; *Kaffee*, Ger.

Composition.—Coffee contains an alkaloid—caffeine—which is nearly, if not quite, identical with theine, a principle found in tea; a volatile oil; a form of tannic acid; sugar, gum, etc. The tannic acid is that variety known as caffeo-tannic, or caffeic.

The peculiar odor and flavor of roasted coffee are due to the caffeic acid, which is, in part, converted into methylamine; to the aromatic oil; doubtless, also, to the sugar, which is changed into caramel.

Preparations.—Coffee is never used in the raw state as a beverage. After roasting, it is made into an infusion or decoction. An infusion made at a low temperature, which should not exceed 200° Fahr., is better than a decoction. If the heat be too great, those aromatic constituents which impart to coffee its special aroma are dissipated. Coffee is now usually prepared by the process of percolation.

The best product is obtained by steeping the coffee for some time in hot water. Coffee can be "settled," or clarified, by the addition of some white of egg, or isinglass, or by pouring on from a height some cold water.

Tea.—*The Dried Leaves of Camellia Thea; Thé*, Fr.; *Thea*, Ger.

COMPOSITION.—The constituents of tea are very much the same as those of coffee: theine; an aromatic oil; sugar and gum, and a peculiar form of tannic acid.

PREPARATIONS.—Tea is only used in the form of infusion. The character and quality of the beverage vary greatly with the kind of tea used in the preparation of the infusion. It will suffice to state that green tea is more astringent than the other varieties, partly because it contains more tannin, and partly because it is sophisticated to adapt it to a peculiar taste.

Cocoa.—*Obtained from the Seeds of Theobroma Cacao; Cocoa*, Fr.; *Kakao*, Ger.

COMPOSITION.—The active principle is theobromine, a substance which resembles the alkaloids of coffee and tea, except that it contains more nitrogen than theine and caffeine. Another important difference between cacao and coffee and tea is the large amount of a peculiar fat (cacao-butter) contained in cocoa. There is also present a minute quantity of a volatile oil, on which depends, in part, the characteristic aroma.

ACTIONS AND USES.—The use of coffee and tea, or of a corresponding beverage, is almost universal among civilized nations. This fact is supposed to indicate that a need exists in the human constitution which these beverages supply. Such a view is hardly tenable, the highest physical and mental activity not being incompatible with entire abstinence from them. Under some circumstances, however, they are peculiarly grateful; for example, to remove the sense of fatigue and hunger, and to allay the mental unrest produced by fatigue and anxiety.

Coffee has a somewhat laxative action on most persons; on the other hand, tea has astringent properties—especially that variety known as green tea. It has been affirmed and denied that coffee and tea lessen the rate of tissue metamorphosis, and consequently the excretion of urea. If these beverages check waste, they may be considered as indirect nutrients. If used to excess as beverages, they derange the organs of digestion and excite functional disturbances of the nervous system—on the part of the digestive organs: acidity, flatulence, pyrosis, eructations, etc.; on the part of the nervous system: headache, vertigo, tinnitus aurium, and confusion of mind. The evil results of habitual excess are best seen in sewing-women addicted to tea-tippling. It is not uncommon for these women to live upon tea and bread for long periods, resulting in their becoming excessively nervous and dyspeptic.

The mucus of the stomach plays the part of a ferment; the bread undergoes the acetic fermentation, and this process is facilitated by the presence of a quantity of a weak astringent solution. Disorders of digestion due to this cause can be removed by withdrawal of the offending beverage. It is not less true that the after-dinner cup of coffee not unfrequently assists the digestion of a too elaborate dinner. Those accustomed to the morning cup of coffee are apt to suffer from headache if deprived of their usual beverage, partly because it hastens the intestinal movements and assists the morning evacuation, and partly because it favors the stomach digestion if not taken in excess.

A cup of strong coffee taken in the early morning is held to be prophylactic against malarial infection. Coffee produces wakefulness, and opposes opium narcosis; hence strong black coffee is one of the means resorted to in the treatment of opium-poisoning.

Cocoa, as already set forth, is more directly nutritious than coffee or tea, and, as it is rich in fatty matters, is much more difficult of digestion, so that many dyspeptics cannot use it at all. Cocoa is the most useful beverage in those conditions of the system requiring nutritious aliment, especially in phthisis and similar wasting diseases, and should constitute a part of the diet in these maladies unless it disagrees.

Caffeine as a remedy will be considered in its appropriate place.

Milk.—Regarded from all points of view, milk is the most important beverage. Enough has been said on the subject of milk as a food for invalids; but something additional may be necessary on its dietetic position as an ordinary beverage.

When coffee, tea, and cocoa disagree, milk may be adopted as the ordinary beverage, and usually with great advantage. For breakfast it may be drunk warm. Large draughts of iced milk, according to the American custom, are injurious when drunk at meals; its temperature should not be lower than 60° Fahr. If a sense of weight and uneasiness follow its use, it will be better borne if diluted one-fourth to one-half with lime-water. If it be desired to improve its nutritive qualities, cream to one-fourth or to one-half may be added. In the indigestion of the obese, or in the case of those who suffer from hepatic disorders, the milk should be skimmed. A very valuable nutrient, but which is, unfortunately, not very digestible, is chocolate made with milk and cream. Such an aliment is especially suited to invalids with wasting diseases, but who yet retain the power to digest fats.

Some find it impossible to drink milk, because it induces "biliousness." In this case skimmed milk should be used. Generally the indigestion called "biliousness" means errors of diet in other directions, so that regulation of the food suffices to prevent this form of indisposition.

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WATER.

Water.—*Aqua*, water; *eau*, Fr.; *Wasser*, Ger.; *aqua destillata*, distilled water—water freed from its organic and inorganic impurities by distillation.

Aqua Fluvialis.—River-water.

Aqua Fontana.—Well or spring water.

It is not my purpose to consider fully the subject of the actions and uses of mineral waters. There are special treatises on the subject of mineral springs, to which I beg to refer the reader. Water as a remedial agent, when employed in internal maladies, and as a means of applying heat and cold externally, are the only departments of the subject coming within the scope of this work.

Physiological Effects of Water—internal.—It need hardly be stated that water is an essential constituent of the tissues.

A certain quantity of water or fluid aliment is necessary to the digestive process. An excessive quantity impairs digestion, by so far diluting the gastric juice as to render it incapable of dissolving the foods. Pepsin—the digestive ferment—is also weakened by too great fluidity of the stomach contents. The free use of cold drinks—ices and iced-water—seriously disorders digestion by suspending the action of the pepsin, by diminishing the blood-supply needed by the stomach in its condition of functional activity, and no doubt also by depressing the nerves of the organs of digestion. To this state, induced by the free use of very cold drinks during meals, or during the time of digestion, has been applied the term "*ice-water dyspepsia*," a very common malady in the United States.

A glass of cold water in the morning before breakfast will in many persons cause a satisfactory evacuation of the bowels. The activity of the water is increased by the addition to it of a teaspoonful of common salt.

Although water is essential to the constitution of the fluids and solids of the body, there is no doubt that large and frequent draughts of water may prove injurious by too great increase in the fluidity of the blood, and a consequent damage to the red corpuscles.

The free use of water promotes nutritive changes, and causes in some subjects a decided increase in the formation and deposition of fat. The presence of water is essential, of course, to the metamorphosis of tissue, whether physiological or pathological. The efficacy of mineral waters is in part due to the quantity of water taken, besides the mineral constituents. Water may be taken with the view to cause increased excretion of certain substances. As a large part of that taken passes out by the kidneys, the functional activity of these organs is promoted by free drinking. With the water also passes out an increased amount of urea, chloride of sodium, and phosphoric acid, the product of the more rapid tissue-changes which ensue. The increased elimination of chloride of sodium does not continue, however.

Water is also excreted by the skin, and free water-drinking promotes the cutaneous transpiration, especially when its action is aided by external warmth. The vapor of water also passes out abundantly in the breath.

Physiological Effects of Water—external.—The influence of temperature must necessarily be considered in connection with the effects of water when applied externally.

Effects of Cold Water.—When an extremity—for example, the hand—is immersed in cold water, the temperature of the other hand also falls. Cold water abstracts the heat of the body, at least of its superficial surface, and affects the condition of the internal organs through the nervous system. It is through an influence transmitted from the peripheral distribution of the nerves of the hand to the centre, and thence reflected to corresponding anatomical nervous connections on the other side, that the fall of temperature in the one hand is due when the other hand is immersed in water. We have a right to assume, therefore, that, when cold water is applied to the whole surface of the body, changes of temperature take place within. Indeed, it has been shown experimentally by Brown-Séquard, that ice applied to the lumbar region causes a contraction of the arterioles of the kidneys, and consequent diminished blood-supply to these organs.

When a cold bath is entered, a marked sense of chilliness is experienced, the skin becomes pale and is roughened by the erection of the hair-follicles (*cutis anserina*), the lips are blue, the breath has a spasmodic and catching character, and the pulse is quickened. The temperature of the surface is lowered, for the blood accumulates in internal organs, and the nerves of the skin are depressed. To the change in the conditions of the blood-supply, and the impression of the cold on the peripheral expansion of the nervous system, are due the coldness of the surface, the sobbing respiration, and the feeling of discomfort and depression. If the temperature of the water be not too low, and if the bodily vigor be sufficient to withstand the shock, the condition known as "reaction" speedily ensues. The coldness and depression are succeeded by warmth and a feeling of exhilaration; the pulse quickens, and the respiration becomes easy and unembarrassed; and the muscular strength is increased. If, however, the body be immersed for too long a period, the condition of reaction is supplanted by coldness, depression, weakened pulse, and muscular debility. This result is largely due to the continuous abstraction of heat, to the accumulation of blood in the great venous trunks, and the consequent interference with the metamorphosis of tissue. If healthy reaction comes on after bathing, the effects are those to which we apply the term *tonic*. The circulation is invigorated, tissue-changes take place more rapidly, and the products of increased tissue-metamorphosis are found in the urine. With the increased activity of the function of assimilation, the appetite and digestive power are improved, and the body gains in weight.

Effects of Warm Water.—The degree of effect which is produced by the immersion of the body in warm water is influenced by the temperature; but the quality of the effect is the same at all degrees from tepid to hot. The sense of warmth is at first grateful to the feelings; the skin becomes red from the increased activity of its vessels; the pulse quickens in beats, but diminishes in tension; the respiration is more frequent; præcordial oppression is experienced; an unpleasant sense of distention is felt in the head, and giddiness, faintness, and muscular languor, finally, are produced, if immersion be prolonged or the temperature be too high. The pulmonary and cutaneous transpiration are increased by the warm bath; the temperature of the body rises, and a condition is established by a hot bath, similar to the febrile state. Rapid disintegration of tissue ensues, the waste products escape chiefly by the skin and pulmonary mucous membrane, and decided loss of weight results.

MODES OF APPLYING WATER.—The water of a *cold bath* should have a temperature of 40° to 60° Fahr. If employed for its tonic action, the patient should not remain in it longer than the period of complete reaction. The *tepid bath* has a temperature of from 85° to 95° and the *warm bath* from 95° to 100° Fahr., and the *hot bath* from 100° to 106° Fahr. The duration of the stay in these will depend on the purpose to be accomplished, whether mere excitation of the circulation in the skin, diaphoresis, or muscular relaxation. In directing the warm and hot bath, it should not be forgotten that a diseased state of the cerebral arteries is a contraindication to their use.

The vapor of water in the form of the *Russian bath*, *steam-bath*, or *warm* or *hot wet-packing*, may be used to accomplish the same objects as those obtained by the warm or hot bath. Without entering unduly into the details, it will suffice to state that the Russian bath consists in the exposure of the body in suitable apartments to the vapor of hot water, at a temperature gradually increased from 96° to 140° Fahr. The bath should not, under ordinary circumstances, exceed fifteen minutes in duration. In order to overcome the relaxing and debilitating effects of the bath, the patient should either enter a cold bath or have cold water dashed over his body. This expedient, conjoined with friction of the surface, increases materially the good effects of the Russian bath. In the absence of special arrangements for giving the Russian bath, simple means will suffice. The patient may sit upon a low stool with a blanket pinned about his neck, and under this the vapor of water may be conducted. Or, if confined to bed, the patient may be placed on a gum-cloth, and the blanket may be elevated above him by hoops, arranged transversely, under which the vapor of water may be conveyed from an ordinary tea-kettle. Fresh lime is sometimes used to generate hot vapor. The patient is placed on a low stool and surrounded by a blanket. Some pieces of *freshly-burned* lime are then dropped into a vessel of water placed under the blanket. The slacking of the lime causes great heat, and the consequent generation of a considerable quantity of watery vapor, which also carries up with it minute particles of lime. This proceeding is said to be especially efficacious in membranous croup and diphtheria.

Enveloping the body in cloths wrung out in hot water, or wrapping in a sheet which has been wrung out in hot water, and then covering with blankets, is a mode of applying moist heat which may be advantageously used. To various parts of the body, under the designation of "fomentations," warm and hot water applications are constantly used in domestic practice.

The Wet-Pack.—This efficient means of producing the good effects of cold-water applications consists in wrapping the body in a linen sheet wrung out in cold water. The appliances are these: An ordinary single bedstead; a hard mattress covered with several thicknesses of blankets or comforters; a linen sheet. The sheet is dipped in cold water, and, when thoroughly wrung out, is laid smoothly on the bed. The patient reclines on the sheet, his head supported by a pillow. One side of the sheet at a time is then drawn over the patient's body and neatly tucked under the opposite side, the feet and legs being lifted up and the sheet made to entirely envelop them. Some blankets or comforters are now closely applied around the body of the patient. There is at first experienced a disagreeable sense of chilliness and discomfort, which is soon succeeded by a delightful glow. When reaction is fully established, the wet-pack should be removed, and the body be well rubbed with dry towels. The duration of this application should be from fifteen minutes to an hour. When active diaphoresis is the object to be accomplished, the patient must be well enveloped in blankets, and continue in the bath for the longest period mentioned above.

The Rubbing Wet-Pack.—This is a convenient mode of taking the morning bath as a hygienic measure, and also of procuring more speedily some of the good effects of the wet-pack as applied above. It consists in enveloping the body with a sheet dipped in cold water, and rubbing vigorously with the sheet to induce reaction quickly. The patient stands up during the application, and an attendant rubs those parts inaccessible to the patient. When the sheet is removed the skin is dried by the vigorous application of coarse towels, and the patient immediately puts on his clothing.

When it is not advisable to apply the wet-pack to the whole body, or when local diseases require limited application of the wet-pack, the sheet may be wrapped around the trunk only, or be confined to the region of the affected organ. In cases of extreme debility, or in very susceptible persons, the sheet may for the first applications be wrung out in tepid water, and subsequently the temperature of the water be lowered to that of the air (40° to 70° Fahr.).

The Douche.—This consists in the impact against the body of a column of water from a height. No greater height than ten feet, and a column not larger than four inches, will be proper or safe under any circumstances. A hose attached to a water-pipe, the supply being regulated by a stopcock, is a convenient mode of using the douche. In domestic practice a large pitcher or water-bucket, if provided with a suitable spout, may be utilized for this purpose. The douche may be either cold, tepid, or hot; it may have a direction descending, ascending, vertical, horizontal, or oblique; and the effect may be regulated by the height from which the water is projected, the size of the stream and the force with which it is thrown against the part. As the effect of the douche is very great when the water is cold, when the volume of the stream is large and when it is thrown with force, it is obvious that care must be used in directing it against the head, the chest, and the abdomen. As a rule it is too violent a measure to be employed in weak and susceptible subjects about the trunk, but it may be used freely, of course, on the extremities.

The Hip or Sitz Bath.—As regards temperature, this bath may be cold, tepid, warm, or hot, according to the indications requiring it. The apparatus for administering it consists of a tin or wooden tub of sufficient capacity to contain water enough to cover the hips and lower part of the abdomen when the patient sits down in it. The tub should have a raised back to support the patient, and should be sufficiently elevated above the floor, so that the feet may rest comfortably when the patient sits down in the water. In the absence of a special arrangement of this kind, any ordinary washing-tub will suffice. The duration of the hip or sitz bath will be from five to thirty minutes.

Besides these, various local baths, cold, warm, or hot, under various designations, are used in medical practice, e. g., foot, hand, elbow, and head bath. The effects of these differ in no wise from the baths already described, except in degree.

THERAPY.—The applications of water in the treatment of disease are numerous and important.

In *tonsillitis*, *diphtheria*, and *croup*, ice held in the mouth and allowed to come in contact with the fauces is extremely serviceable. The wet pack to the neck gives great relief in the same diseases. The mode of applying it is as follows: A napkin is wrung out in iced or cold water and wrapped around the neck; and over this is put a dry towel or napkin to prevent evaporation, and also the wetting of the patient's clothes. In *spasmodic croup* (*laryngismus stridulus*) the application of iced-water in this way will frequently very quickly stop the crowing inspiration and allay the distress of breathing. A cold douche will effect the same result, but this is an unnecessarily harsh remedy in these cases. Sometimes hot applications are more efficacious, when the napkin or towel may be wrung out in water as hot as can be borne. Cold affusion, or, better, sponging of the body with cold water, is an excellent means of preventing *laryngismus stridulus* when it arises from cold.

Habitual constipation may sometimes be overcome by a glass of cold water taken before breakfast. *Hæmorrhoids* that bleed, especially when attended by constipation, are improved by a daily rectal injection of cold water. When cold or warm water injections are used to cause an evacuation, it must be remembered that, usually in adults, a large amount of water is necessary—about one quart. A small quantity of iced-water may be effective, for in this case the impression of the cold on the nerves of the rectum excites a reflex action of the whole intestinal canal.

Pure water or distilled water is an effective diuretic, especially adapted to the relief of *acute desquamative nephritis.* The action consists in free discharge of the surplus water by the kidneys, and the consequent washing out of the tubules obstructed by the cast-off epithelium and tube-casts. Large draughts of water, as has already been stated, carry out from the kidneys the products of retrograde metamorphosis, and hence the action is diuretic in the widest sense. The efficiency of many infusions, decoctions, and ptisans, employed in dropsies, is largely due to the amount of water ingested. The internal use of water in kidney-diseases may be supplemented by hot fomentations to the lumbar region. (*See* article DIGITALIS.) As irritation of the skin of the back has been shown experimentally to influence the calibre of the renal arterioles, there is sufficient warrant for the practice of applying these fomentations to the lumbar region, when the functional activity of the kidneys is insufficient.

When renal disease is so far advanced that the *elimination of urea is seriously hindered*, and *stupor*, *somnolence*, *muscular twitchings*, and even *convulsions* occur, great relief is obtained by exciting free action of the skin by means of the vapor-bath or hot wet-pack, the patient being well enveloped in blankets to favor powerful diaphoresis. The Turkish bath is very serviceable to restore the suppleness of joints and muscles after an attack of *acute rheumatism*, and *chronic muscular rheumatism* is benefited by the same means. No permanent good result can be expected from these baths in chronic rheumatic arthritis.

As a means of causing elimination of *mineral poisons*, baths are useful. *Lead*, *mercurial*, and *paludal cachexiæ*, are relieved by the Turkish bath and the wet-pack, and, although these means are insufficient of themselves to effect a cure, they aid very materially the action of other remedies. Increased metamorphosis of tissue and increased excretion, are it will be remembered, constant effects of these baths. If the wet-packing be used, free diaphoresis should be encouraged, by abundant covering and by large draughts of water.

One of the most important recent improvements in therapeutics is the treatment of *fevers* by cold baths. This is an old expedient, it is true, but it is only within a few years that the treatment of fevers by baths has been placed within the domain of strictly scientific investigation. Various means of applying water in fevers have been resorted to—cold affusion, cold baths, cold wet-pack, ice-bags, etc. Cold affusion consists simply in dashing successive buckets of water over the patient, stripped and lying on a mattress protected by a gum-cloth. The applications are continued until the temperature is reduced. This is a crude method, and wears an aspect of harshness which may prevent its efficient use in private practice. The cold bath is more serviceable and is free from the objectionable features of cold affusion. As practised according to the method of Ziemssen, it is grateful to the patient, produces no shock, and exerts a powerful influence over the temperature. The fever-patient is put into a bath about the normal temperature of the body (98° Fahr.), and the water is cooled, by the addition of ice, to 80° Fahr., to 60° Fahr., or even to 40° Fahr., according to the effect produced on the temperature, which, for this purpose, should be taken in the rectum. When a positive reduction of the fever-heat has occurred, at the expiration of five minutes to half an hour usually, or longer if necessary, the patient should be wiped dry, placed in bed, and covered with blankets. The bath may be used according to the nature of the case, from two to six times each day, but less frequently if the duration be longer than a half-hour. The appliances for administering baths to fever-patients are: A strong sheet for lifting the patient from the bed into the bath-tub; a bath-tub provided with an exit-pipe for drawing off the surplus water; a thermometer for ascertaining the temperature of the bath, and a clinical thermometer for noting the variations of temperature of the patient. Hospitals should be provided with such arrangements as have been made at the London Hospital for the use of baths in fever. These consist of a small ward with two beds; a bath-tub supplied with hot and cold water; a tank, with which the cold-water pipe communicates, in which ice may be put if necessary; and a large waste-pipe for disposing quickly of the surplus water.

In the absence of suitable bath appliances, the temperature of fever patients may be reduced by simpler methods. Iced-water may be injected into the rectum frequently; cloths dipped in iced-water may be applied to the trunk, and Chapman's ice-bags may be put to the spine. More suitable than these methods is the wet-packing. Although the wet-packing is not so effective as the bath, it is a very powerful means of reducing fever-heat, and it has the merit of simplicity of application, so that in every household it may be used if necessary. The patient may be put into the wet-pack several times each day, according to the state of the temperature, and may remain in it from five minutes to an hour.

If, after the application of water by any of the modes above mentioned, the circulation becomes feeble, the extremities cold, and the lips blue, stimulants should be administered and bottles of hot water applied to the feet. The good effects of baths are these: the temperature declines, the pulse falls and becomes soft and compressible, the skin grows moist, and the patient feels refreshed. The repetition of the bath or of the application of cold water will be determined by the rise of temperature, and of the pulse. Some practitioners employ them regularly, as for example Von Ziemssen and Immerman, who administer them at 6 A. M., 1 to 3 P. M., and 7 P. M.; but others—and this the author thinks the better plan—give them more or less frequently according to the range of temperature. Not only is the mortality of typhoid greatly less under hydrotherapy than under any other method of treatment, but the complications which belong to it—except hæmorrhage—occur less frequently.

The most conspicuous triumph of the water-treatment of the pyrexial state is seen in the management of *hyperpyrexia*, a condition of things in which a sudden and rapid rise of temperature takes place, the range being in extreme cases from 105° to 112° Fahr. It is now perfectly well known that any temperature above 108° Fahr. is almost necessarily a fatal sign. This condition of hyperpyrexia occurs sometimes in *acute rheumatism*, *delirium tremens*, *fevers*, etc., and has heretofore not been amenable to treatment. A fatal result in these cases may be averted by cold baths, the temperature of the bath being rapidly reduced from 96° to about 60° Fahr., by the addition of ice. It is sometimes necessary in these cases to prolong the stay in the bath to two or three hours, but it must not be forgotten that no absolute rule can be made, the state of the patient's pulse, respiration and temperature being the guide not only as to the temperature of the bath, but the duration of the stay in it.

Typho-malarial fever is best treated by the same means; but malarial fevers are, of course, so unquestionably remediable by quinine that any other treatment is a waste of time. Baths are, however, extremely grateful in the pyrexial stage of malarial fevers.

Cold baths are of equal utility in *scarlatina*. In mild and uncomplicated cases of this disease, no remedies are required, and simple sponging of the body, followed by inunctions of oil, is all that is required. When, however, the temperature rises to 104°, 105°, 106° Fahr., and higher, and there is delirium or stupor, the rash being dark and indistinct, and the urine scanty, the cold wet-pack will often render most signal service. The rash will reappear and become vividly red; the pulse, respiration, and temperature, will decline. The cold wet-pack to the neck, and frequent gargling of the throat with warm water, relieve the sore-throat, and are really more effective than the caustic applications so commonly resorted to. When the urine becomes scanty and highly albuminous, hot fomentations to the lumbar region, with or without addition of medicaments, are often very serviceable. The vapor-bath, or the warm wet-packing, by determining free diaphoresis, relieves the brain when convulsions are threatened, or have actually occurred, from uræmia.

Other eruptive diseases, *measles*, *small-pox*, *cerebro-spinal meningitis*, are advantageously treated in the same way.

Constitutional syphilis is very much ameliorated, and the cure by specific treatment hastened, by a course of Turkish baths, or wet-packing. Three baths should be taken each week. If the wet-packing be used, the patient should remain in it until free diaphoresis is produced.

The wet-packing is very efficacious in *acute rheumatism*, but the prejudices of the patient, and of the patient's friends, often interfere to prevent its use. If there be much pain and soreness, the front of the body may be packed, and the inflamed joints may be separately swathed, but, whenever practicable, the packing should include the whole body. A vapor-bath is often very serviceable. A vinegar vapor-bath has been used, it is said, with great advantage. This application may be readily made in the following way: Some bricks are previously heated; the bedclothes are elevated above the patient by hoops transversely placed; and vinegar is poured over the heated bricks, which have been laid under the bedclothes. The perspiration which follows these baths should be wiped off, the skin quickly sponged with tepid water, and then dried with a soft towel. Great relief is experienced from these applications; the joints are less tender, the fever declines, and the acid perspirations are diminished. *Chronic rheumatism*, if chiefly muscular, and if changes have not occurred in the joints, which are simply stiff, and *chronic gout*, are much benefited by the Turkish bath.

In *acute cerebral congestion*, the cold douche may be applied to the head, while the feet are immersed in warm water. A piece of ice, held against the nape of the neck, acts powerfully in the same way. The alternate application of ice and hot water is often more effective than ice alone. The author has seen these alternate applications of ice and hot water have an excellent effect in the stupor of *opium narcosis*, of *uræmia*, and in *carbonic-acid poisoning*, occurring under various conditions.

In *inflammatory affections* of the meninges, and in *meningeal hæmorrhage*, a bag or bladder of pounded ice has the sanction of universal use. The author believes that these applications are often made without due discrimination in *cerebral hæmorrhage* and other allied states. When the face is pale, the surface cool, and the circulation depressed, cold applications to the head are harmful. Ice to the head, and frictions of the surface with ice, are very serviceable in *sunstroke* or *thermic fever*, when the surface is hot, the pupils contracted, and the pulse full and bounding. The cold wet-packing gives great relief under the same circumstances, but, when the symptoms of depression exist, these cold applications are hazardous. Usually, however, in *thermic fever*, the range of temperature is very high, and the most important indication is to abstract the heat, which can be best accomplished by application of ice or the cold wet-pack, or the cold bath. The results of the practice are in accordance with this theory, for these applications have been most successful in restoring patients in imminent danger of death. When, in *delirium tremens*, the head is hot, the conjunctivæ injected, the face flushed, and the pulse strong, an ice-bag to the head, or cold affusion, or a mild douche, will assist in quieting the patient, and favor the production of sleep; but these measures will do mischief when considerable depression of the bodily powers exists, and they are of doubtful utility in any case affording evidences of atheroma of the cerebral arteries, or of cardiac disease. Cold affusion to the head and spine, and cold baths, are among the most important means of relief in *chorea*. *Wakefulness* in children and adults may be often overcome, and quiet sleep insured, by a tepid bath taken just before retiring; but, when the head is hot, the eyes brilliant, and the circulation active, cold should be applied to the head, while the body is immersed in the tepid bath.

The shower-bath, the douche, and cold affusion, were formerly much used to calm the violence of *acute mania* and *maniacal delirium*. The great depression of the powers of life which the douche and the shower-bath have caused in some cases, and the fatal results which have occurred during their administration, have led to their disuse by many alienist physicians. By others, they are held to be extremely serviceable in appropriate cases. Bucknill and Tuke advise the occasional use of the shower-bath in the *excitement* of *intercurrent mania* and *monomania*, and a daily shower-bath in *melancholia*. They advise, further, that the shower-bath should, in the first-named group of cases, be used no longer than three minutes, and in *melancholia* from fifteen to thirty seconds, the patient being dried while standing in a pan of hot water. The same authors prescribe a warm bath of thirty minutes, at 95° Fahr., for the excitement and sleeplessness of various forms of insanity, and they affirm that its "tranquillizing effect is often wonderful." The simultaneous use of cold affusion to the head and the warm bath has been warmly advocated by M. Brierre de Boismont, and is decidedly approved by Bucknill and Tuke, who advise that the duration of the bath should not exceed one hour. The wet-pack is an exceedingly valuable remedy in the excitement of *acute mania*, but this measure should not be allowed to degenerate into a means of restraint merely. It should be applied in the mode already described, and the patient should continue in it until free diaphoresis is established.

In *infantile convulsions* great benefit is derived from the general warm bath combined with cold affusion, or an ice-bag, to the head. *Hysterical convulsions* are quickly relieved in the same way, and the *hysterical state* is much improved by a daily shower-bath.

Water, cold and warm, in the state of vapor, as ice, has been largely applied in the treatment of *tetanus* and *hydrophobia*, but without good results beyond the merest temporary assuagement of the patient's sufferings.

Lesions of the Spinal Meninges and of the Cord, corresponding pathologically to those of the brain, are remediable by similar means as respects hydrotherapy. The author has seen remarkable improvement follow a hot douche to the spine in a case of paraplegia of syphilitic origin. The *backache* so common in women, and frequently due to anæmia of the cord, may be much relieved by a sponge dipped in hot water and passed over the spine. The hot douche to the spine is often more decidedly serviceable in these distressing cases.

Alterations of sensibility, *analgesia*, *anæsthesia*, *hyperalgesia*, *hyperæsthesia*, are often relieved by hydrotherapy—by the wet-pack, by ice, by local hot and cold effusion. Neuralgic affections, especially *sciatica*, are benefited greatly by the wet-pack. Paralyzed parts that have become cold and that waste, and that are undergoing other nutritive changes, are improved in condition by douches, by wet-packing, and other methods of the water-cure.

In *inflammatory affections within the chest*, wet-packing is very useful. As a rule, a hot wet-pack gives more relief than a cold one, but the feelings of the patient are a proper guide. In *acute pleuritis* a cold wet-pack applied to the side unquestionably diminishes the pain, and no doubt relieves the inflammation. In *pneumonia* hot wet-packs are more suitable. When the organs within the chest are inflamed, it is good practice to wrap the whole chest tightly in a pack to limit the motion of the chest-walls. The method of proceeding is as follows: Wring out in cold or hot water a large towel, fold it and place over the affected side or part; have in readiness a bandage or long towel sufficient to encircle the chest, and confine the wet-pack by pinning as tightly as possible around the chest the bandage or towel. Spongiopiline is an excellent material for making these hot or cold applications. The same expedients—the application of cold and the tight bandage—are of great utility in *pulmonary hæmorrhage*, but a more decided effect, by means of ice-bags to the chest and back, may be procured in this condition of things.

Cold and hot applications have unquestionable value in *inflammatory affections of the abdominal organs*. The author has seen excellent results from the application of an *ice-bag* over the swelling in cases of *typhlitis* and *perityphlitis*. *Peritonitis* is similarly treated with advantage. When the inflammation is recent, the abdomen may be covered with an ice-bag of sufficient size. It has been shown that not only may the local symptoms of inflammation be abated in this way, but the general temperature of the body be thus reduced. It is proper, in making these cold applications, to interpose a napkin or towel between them and the skin.

Pounded ice is an excellent application to *strangulated hernia* to favor reduction, and this has often been sufficient when the taxis failed. *Hæmorrhoids* that are much swollen and painful, or that bleed, are much improved by applications of ice. *Bubo* and *swelled testicle* are greatly benefited, and the pain attendant on them relieved, by ice.

Cold to the abdomen in the form of ice or cold water, and ice-water thrown into the uterus or ice introduced into the cavity of the womb, are measures of great utility in *uterine hæmorrhage*, whether from threatened *abortion* or *post partum*.

Hot-water injections, or the hot douche, is one of the most effective measures to be used in *chronic metritis.* A large quantity of water and frequent applications are needed to procure the best results. Not less than a quart of water as hot as can be borne, and three applications each day, are necessary. A Davidson's syringe, a vessel containing hot water, and a suitable vessel to receive the water as it flows away, are the materials needed for the vaginal douche. The first effect of this is to increase the blood-supply, but a marked degree of pallor of the mucous membrane follows, the opposite effect to that caused by cold water. When there is great relaxation of the vaginal passage and the uterus is large and spongy, the cold douche is more serviceable. Excellent results are sometimes obtained by the alternate use of the hot and cold douche.

The applications of water in *surgical practice* are numerous and important. As a dressing for *wounds, contusions, and inflamed parts,* it is in universal use. The author is convinced that the cold-water treatment of wounds is often overdone, the circulation in the wounded part being too much depressed, whence repair is slow or sloughing is induced. The hot-water dressing, or the immersion of the affected part in hot water (95° to 100° Fahr.), as proposed and practised by Prof. F. H. Hamilton, of New York, is a method which promises most successful results:

"The phenomena usually observed in cases of recent lacerated or incised wounds, when submerged, are a sense of comfort, yet not absolute relief from pain; on the second or third day the parts adjacent are swollen but not much reddened; the integument generally assumes a white and sodden appearance, and with only slight tenderness. On the fifth, sixth, or seventh day, the swelling is greater than usually accompanies other plans of treatment; and, with the inexperienced, is likely to excite alarm, but it is found not to be attended with increased tenderness, and it pits under pressure, showing that it is a condition of œdema chiefly. At this time the granulations are generally covered with lymph, or some exudate of a whitish color, and which might easily be mistaken for a diphtheritic deposit. At the end of fourteen days or thereabouts (the period at which, in most cases, we substitute fomentation for submersion) the limb is still œdematous, the granulations are abundant, sometimes presenting a fresh red appearance, and at others covered with the white exudate."

Prof. Hamilton further remarks: "No treatment hitherto adopted, under our observation, has been attended with equally favorable results. Under this plan the area of acute inflammation is exceedingly limited; erysipelatous inflammation has been uniformly arrested or restrained when it has actually commenced, and it has never originated after submersion; gangrene has in no instance extended beyond the parts originally injured, and, when progressing, it has in most cases been speedily arrested (in gangrene, hot water or water at a temperature of from 100° to 110° Fahr. is to be preferred). Septicæmia and pyæmia have not ensued in any case in which submersion has been practised from the first day of the accident. Purulent infiltrations and consecutive abscesses have been infrequent, and always limited to the neighborhood of the parts injured, and of small extent. Traumatic fever, usually present after grave accidents, when other plans of treatment have been pursued, as early as the third or fourth day, has seldom been present when this plan has been adopted, and in no case has the fever been intense or alarming."

For the immersion of hand, foot, arm, and leg, Hamilton has constructed bath-tubs of peculiar shape. He advises this method of treatment in contused or lacerated wounds of the extremities. Simple incised wounds and amputations are unsuited to this plan of treatment.

I subjoin the titles of some of the most recent and important contributions to our knowledge of the actions and uses of water. It is proper to add that I have also consulted the works of the followers of Priessnitz, but they are singularly deficient in accurate and scientific knowledge.

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HAMILTON, DR. FRANK H. *The Medical Record*, New York, vol. ix., May 15, 1874.

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HEAT.

PHYSIOLOGICAL ACTIONS.—It is difficult to assign heat to its proper position in a systematic classification. As a stimulant to the vital processes, it pertains to the class of agents promoting constructive metamorphosis; but, in its influence on the interchanges of repair and waste, the action quickly passes into the stage of waste. As its therapeutical employment is almost entirely confined to the range of constructive metamorphosis, it seems more appropriate to embrace it in this division of the subject.

The normal heat-production of the body varies singularly little in health. Every considerable rise of temperature above, every considerable fall below, the normal of 98.5° Fahr., indicates the existence of disease. The various external causes of disturbance of the heat-producing function of the body do not, in health, affect the normal standard, because of the existence of a regulating apparatus. Every one is familiar with the fact that the human body can be exposed, without risk, to a temperature much above its own standard, provided the heat-regulating function is in a condition of healthy activity. If, however, the transmutation of heat into another mode of motion cannot be effected, then the complexus of morbid actions, called fever, is at once established. Every increment of heat added to the body, unable to transmute it into another mode of motion, adds to the existing temperature.

Very important alterations take place in a body, the seat of a febrile process. Increased waste, the result of more rapid oxidation, takes place; the excretion of urea, and, according to some authorities, of carbonic acid, is increased; and those important and wide-spread lesions, entitled parenchymatous degenerations, occur in various organs of the body.

Modes of applying Heat.—1. SOLAR HEAT.—The rays of the sun may be applied directly to the whole surface, or to any part of the body. When the whole body is exposed to the rays of the summer sun, the head and face ought to be protected. The skin becomes warmer, the capillaries dilate, an erythematous blush appears, and the amount of blood in the peripheral vessels is increased above the normal. The rays of the sun in midsummer, ranging from 95° Fahr. to 125° Fahr., produce considerable burning heat, and cause a superficial inflammation of the skin, which is followed by desquamation. When the heat is less powerful, only an agreeable sensation of warmth may be experienced. Decidedly caustic effects may be produced by the concentration of the solar rays on a small spot of integument by a double-convex lens—a burning-glass, it has been called. This may be utilized as a means of counter-irritation.

Besides the heat, the solar rays contain chemical or actinic rays; and hence it is not improbable that chemical effects of a very important kind, or, it may be, catalytic effects, follow the application of the solar rays to a considerable portion of the body. Further, it cannot be doubted that excitation of the cutaneous nerves by the heat and chemical rays of the sun must affect the condition of the brain and spinal cord, and, through the sympathetic system, the nutrition of the body.

2. **ARTIFICIAL HEAT.**—There are various modes of applying artificial heat. It may be dry or moist.

MOIST HEAT.—*The Vapor-Bath.*—It consists simply in the application of the vapor of water to the surface of the body. Sufficient attention, for the limits of this work, has been bestowed on this subject in the article on "Hydrotherapy."

DRY HEAT.—To the general surface of the body dry heat may be applied by simply raising the temperature of the air of the apartment, the body being uncovered. Local application of dry heat may be made to any part by means of woolen cloth, earthen plates, sad-irons, bags of salt, bricks, etc., heated to the proper temperature. The effects of these applications depend largely on the amount of heat contained in these objects. They produce at first the sensation of warmth, redness of the skin, and may cause vesication, or deep-seated burning and destruction of the tissues.

The Turkish Bath.—This differs from the Russian bath, in that it consists of dry air without the presence of the vapor of water. The human body can exist in dry air at a very high temperature, without injury, for a short period, provided it is in a state of health. The temperature of the air of the Turkish bath ranges from 75° Fahr. to 160° Fahr., but the highest point is attained at the conclusion of the process. There are usually three apartments, so that the patient passes from one grade of temperature to another, and thus avoids the unpleasant, even dangerous, effects of high heat suddenly applied. When the temperature reaches 100° Fahr., already some distress is experienced; the breathing becomes short, hurried, and labored; the action of the heart is tumultuous; an unpleasant sensation of heat and irritation, with itching, is felt over the whole body; the head has a feeling of fullness, with constriction of the forehead and ringing in the ears; perspiration soon begins, and, when the temperature reaches the highest point, is very profuse.

It is obvious that a decided impression is made on the organism by a Turkish bath. The first effect of the heat is on the sensory nerves—the impression of warmth. The peripheral vessels dilate, and, of course, admit into them a larger amount of blood, with the effect to diminish the amount of blood in the internal organs. The temperature of the blood rises with the increase of heat; the action of the heart corresponds, and a state of fever would be quickly induced if the excess of heat were not at once disposed of by the perspiration, in which, according to the doctrine of the correlation of forces, it disappears as motion. The circulation being more rapid, and the peripheral vessels containing more blood, a more active metamorphosis of tissue probably takes place. Elimination is more active through the skin, but is less active through the intestinal canal and the kidneys. The acidity of the urine is increased, and the water and salts are relatively diminished. Remotely, the tension of the vascular system falls, absorption becomes more active, the muscular tonus declines, and the sensibility of the nervous system and of the special senses is lowered.

THERAPY.—Warm applications possess a high degree of utility in the various *painful and inflammatory affections of the abdominal organs.* Acute peritonitis, local or general, is probably more frequently benefited by applications of ice. As a rule, the feelings of the patient furnish the guide to the selection of the temperature. In the absence of any specific indication from the feelings of the patient, the following rule may be adhered to: If the case be one of pain without fever or inflammation, warm or hot applications; if inflammatory, cold. Those materials which retain heat and moisture longest are to be preferred; for example, the material known as spongio-piline, poultices of flaxseed-meal, flannels wrung out in hot water, and covered with oiled-silk, etc. When the weight of the application is objected to, a light material, like a bag of hops dipped in hot water, may be applied. In affections of the pelvic viscera, the same modes of application can be resorted to, under the same conditions.

Heat, especially dry heat, is a very important remedy in sudden and alarming *depression of the vital powers*, with feebleness of the heart's action and coldness of the surface. Active hæmorrhage, of course, contraindicates its employment. Feeble infants, born at term or prematurely, are often saved by the application of dry heat—the highest temperature which can be borne without blistering being necessary. The *methodus medendi* is simple enough: the heating of the blood in the superficies of the body increases the movement of both heart and lungs. High heat, especially if long continued, is decidedly contraindicated in cases of fatty and fibroid degeneration of the heart, in cases of carditis, considerable obstruction of the orifices, etc.

Hot-air baths, and hot applications of any kind, may be dangerous in old subjects, and in those persons of middle age who present the evidences of degenerated vessels. Not unfrequently, attacks of *migraine*, cases of ordinary *neuralgia* of the fifth, *tic-douloureux* of mild form, etc., are relieved by hot, dry applications made over the course and peripheral distribution of the affected nerves. *Stupor and coma*, due to *uræmia*, or to *narcotic medicines*, may be relieved by dry heat applied to the neck. The alternate use of cold and heat is generally more efficient. In *neurlgia* of the larger nerves, dry heat is palliative. In irritable spine, the so-called *spinal irritation*, dry heat is an efficient remedy. In these cases solar heat is especially serviceable—the sun's rays falling on the spine, or, what is better, the rays concentrated by a burning-glass on various points on the spine.

Probably the most generally useful application of dry heat is in the treatment of *chronic rheumatism* and in *general dropsy*. In the treatment of these maladies, elimination is the object to be accomplished; in the one case, of certain excrementitious substances, notably of uric acid; and in the other, of water by the skin.

The Turkish bath has an unquestionably good effect in constitutional syphilis. Here there are two objects to be accomplished—to promote the action of the mercurial medicines and of the ptisans, and to secure elimination through the skin. In the same way the Turkish bath is highly useful in *plumbic, mercurial, and paludal cachexiæ.* Our French colleagues maintain the superior value of sulphur-vapor baths in the cachexiæ produced by the mineral poisons.

DIGESTION-FERMENTS

Pepsin.—*Pepsina vel pepsinum; pepsina porci; pepsine*, Fr.; *Verdauungsstoff*, Ger.

Definition.—A ferment obtained from the mucous membrane of the stomach of the pig. There are two processes worthy of mention for obtaining the ferment: Scheffer's, and Prof. Lionel S. Beale's. By Scheffer's process the mucous membrane is digested in a solution of muriatic acid, and the pepsin precipitated with chloride of sodium. Beale directs that the mucous membrane be first cleansed and then scraped strongly with an ivory knife so as to remove the contents of the gastric glands. The pepsin is contained in the very viscid mucus which is thus removed. When spread on clean glass in a very thin layer, it is dried at a temperature not to exceed 100° Fahr., and in the vapor of hot water or over sulphuric acid.

Preparations.—Pepsin saccharata, dose 5 to 10 grains. Vinum pepsinæ, dose ʒ ss—ʒ j. Glycerinum pepsinæ, dose ʒ ss—ʒ j. The wine of pepsin is an unscientific preparation, and should not be prescribed. Boudault's, really Corvisart's compound nutritive powder, consisting of pepsin, starch, and lactic acid, is an exceedingly uncertain preparation, and is often totally inert. Only those preparations of pepsin should be used, made by the processes above described, especially those of E. Scheffer, of Louisville, Ky. The saccharated pepsin and the glycerole are practically unchangeable.

Ingluvin.—This is a preparation from the gizzard of the domestic chicken—*ventriculus callosus gallinaceus.* Dose, gr. v.—℈j.

Ingluvin has the remarkable property of arresting certain kinds of vomiting—notably the *vomiting of pregnancy.* It is a stomachic tonic, and relieves *indigestion, flatulence,* and *dyspepsia.*

The author's experience is confirmatory of the statements which have been put forth regarding the exceptional power of this agent to arrest the vomiting of pregnancy. It can be administered in inflammatory conditions of the mucous membrane, as it has no irritant effect. Under ordinary circumstances, and when the object of its administration is to promote the digestive function, it should be administered after meals. When the object is to arrest the vomiting of pregnancy, it should be given before meals.

Pancreatine—Pancreatic Emulsion.—Ferments of the pancreas, employed with a view to assist the intestinal digestion, especially the digestion of fats.

Antagonists and Incompatibles.—Alkalies and the mineral salts which precipitate pepsin from its solutions (mercury, lead, zinc, and copper salts), tannic and gallic acids, creosote, etc., are incompatible. Alcohol and the various alcoholic liquors, in sufficient strength, destroy the activity of pepsin ; hence the wine of pepsin must be an uncertain preparation.

Synergists.—Lactic and chlorhydric (muriatic), acetic, citric, and malic acids, promote the digestive activity of pepsin. Certain ferments, as ptyaline, pancreatine, extract of malt, etc., also increase its activity.

Physiological Effects.—Ten grains of the saccharated pepsin, prepared by the process of Scheffer, will dissolve 120 grains of coagulated albumen in four to six hours, at a temperature of 100° Fahr. Pepsin is an essential constituent of the gastric juice, and possesses the property, especially in the presence of lactic and chlorhydric acids, of digesting the nitrogenous constituents of the food (caseine, albumen, fibrine, etc.), and converting them into *peptones*.

Therapy.—Pepsin is, of course, indicated in *stomach-disorders*, characterized by a deficiency of this essential principle. As Fenwick has shown, the amount of pepsin secreted by the gastric glands undergoes great diminution in various morbid states, as in cancer, diabetes, typhoid fever, and heart-disease. In convalescence from *fever*, therefore, pepsin is indicated, and in the incurable morbid states, mentioned above, it serves a useful purpose in maintaining the function of digestion. Fox "bears strong testimony in favor of pepsin" (p. 74), in cases of *atonic dyspepsia*, and "irritative states of the mucous membrane." He prefers to administer it with chlorhydric acid. In the atonic *dyspepsia of phthisis* pepsin is highly beneficial, especially when given in connection with pancreatic emulsion. In other forms of dyspepsia, accompanied by imperfect solution of the fats and the formation of fat-acids, the addition of pancreatic solution greatly increases the activity of pepsin (Long).

In the *apepsia* of infants (Barthez), especially occurring in those artificially fed, great benefit is derived from the use of pepsin. Dr. Cummins has seen many apparently hopeless cases recover under its use, and he regards it as so valuable that he never recommends a wet-nurse, but relies on artificial food, the digestion of which is aided by the administration of pepsin. Corvisart used his nutritive powder (the so-called Boudault's pepsin) with happy effects in the same cases; and Barthez, who applied the term apepsia to this inability of infants to digest their proper aliment, has been equally successful in the same mode of treatment. The saccharated pepsin should be administered in these cases in doses of five to ten grains immediately after the child has taken its milk or other food, or ten or fifteen drops of the glycerole of pepsin at the same time. It is better, according to M. Barthez, to give pepsin without acid to infants (Trousseau et Pidoux).

Pepsin is one of the remedies which has been used with success in the *vomiting of pregnancy.*

By facilitating digestion, pepsin relieves the pain and distress caused by deficient elaboration of the foods; hence its utility in relieving the heaviness and torpor which are felt during the progress of digestion in some subjects, and also the *gastralgia* which is produced in this way.

According to Hollman, the use of pepsin is attended with beneficial results in *anæmia*, *chlorosis*, *atrophy*, and allied states, due, no doubt, to the better preparation of the peptones for absorption into the blood.

In *chronic ulcer* of the stomach and in *cancer* of this organ, pepsin, by facilitating digestion, will diminish the distress of the patient and will contribute to the cure of ulcer and prolong life in cases of cancer.

Very great success has been attained in the treatment of *diarrhœa in infants* by pepsin. The form of diarrhœa amenable to this remedy is due really to an atonic state of the intestinal mucous membrane. Every motion contains half-digested food. Soon after taking milk or other food, the child becomes uneasy and a discharge takes place. Frequently undigested food is vomited as well. If this condition of things continues for any considerable time, the child emaciates, and the skin wrinkles and becomes dry and harsh. The motions will be quickly changed in character, and the nutrition of the child improved, by giving pepsin immediately after each supply of food. Facts in illustration of this statement have been published by Corvisart, Barthez, Rilliet, Trousseau et Pidoux, Ellis, of Dublin, Davidson, of Liverpool, Hawley, of Brooklyn, and others.

In cases of entire inability of the stomach to digest food, or when surgical operations or accidental injuries prevent the introduction of aliment into this viscus, *pepsin is added to the nutritive enemeta* in order to insure the preparation of peptones for absorption.

Pepsin is also applied to certain local uses. After the publication of Broadbent's results from the injection of acetic acid into cancerous tumors, Thiersch and Nussbaum introduced the method of gastric-juice injections into the substance of morbid growths. The gastric juice of the pig carefully filtered, or a slightly acidulated solution of pepsin, may be employed for this purpose. The injection should be made with an hypodermic syringe, and the solution should be deposited well into the interior of the tumor. This practice may be useful in cases of fatty tumor or other benign growths, when from any cause extirpation may not be practicable. That malignant tumors may be retarded in growth by this practice is also quite probable, unless the neighboring lymphatics are involved.

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Acidum Lacticum.—*Lactic acid; acide lactique*, Fr.; *Milchsäure*, Ger.

Properties.—Sour, sirupy liquid, having a pale wine-color. Specific gravity 1.212. Mixes in all proportions with water, alcohol, and ether.

Incompatibles and Antagonists.—Alkalies and the mineral salts.

Synergists.—Pepsin, sodium-chloride, vegetable acids, chlorhydric acid.

Dose.—Fifteen minims to ʒ ss in sweetened water.

Physiological Action.—As lactic acid is a frequent constituent of the gastric juice, it has undoubtedly an important function in connection with digestion. Used medicinally it promotes the appetite and facilitates digestion. In large doses (ʒ j) it gives rise to epigastric pain, flatulence, and loss of appetite. As lactic acid is one of a series of homologous acids, containing butylactic, valerolactic, and leucic acids, it is not improbable that some of these may result from its oxidation when administered in excess. It probably combines with bases and forms lactates, for it displaces not only the volatile but some of the mineral acids from their combinations. Chemical investigations have indeed confirmed this, for, besides free lactic acid, lactates have been found in the gastric juice. It is not known definitely whether free lactic acid occurs in the blood in the healthy state, but it certainly does in some morbid conditions. According to Lehmann, lactates are rapidly converted into carbonates in the blood. Free lactic acid, as was long ago shown by Berzelius, is found in muscular fluid, and has also been detected in the spleen by Scherer. Although it is not always a constituent of normal urine, yet, when the supply of lactates to the blood is considerably beyond the oxidizing power of the blood, it has been found (Lehmann). Scherer has shown also that lactic acid is present in the exudates of puerperal fever.

Lactic acid has the power to dissolve a considerable quantity of freshly-precipitated phosphate of lime.

The suggestion made by Prout, of a relation between an excess of lactic acid in the blood and rheumatic inflammation, received a remarkable confirmation in the experiments of Richardson, who produced endocardial inflammation by injecting lactic acid into the peritoneal cavity of dogs. Further confirmation of this connection has been afforded in the attacks of acute rheumatism which have occurred in subjects of diabetes treated by lactic acid.

THERAPY.—Solutions of lactic acid are of great utility as *solvents of false membrane.* Since the comparative demonstration of solvents made by Bricheteau and Adrian, it has been employed successfully by Dr. Weber, of Darmstadt, and Dr. Dureau, in *croup*, applied by means of a *pulverisateur* in the strength of thirty to forty drops to the ounce (Waldenburg). The following is the formula of Morell Mackenzie of the London Throat Hospital: ℞. Acidi lactici, ʒ iijss.; aquæ destil., ℥ x. M. This may be used in a spray-producer, or be applied on a mop to the affected part. It is unquestionably an excellent solvent of the exudation of *diphtheria*, as the author has frequently observed. It may be used also as a gargle when the exudation does not extend beyond the tonsils and the pillars of the fauces. For this purpose sufficient acid may be added to water to give a distinctly sour taste. As the application is free from danger, it may be used as often as every half-hour. When used in the form of spray, care must be had to prevent the acid hurting the eyes.

It is chiefly in *atonic dyspepsia* that lactic acid is employed. In this condition lactic acid is, so to speak, a physiological remedy, for we supply it artificially because the stomach is unequal to the task of producing it. Generally, it is advisable to combine pepsin with it thus: ℞. Glyc. pepsinæ, ʒ xij.; acidi lactici, ʒ iv. M. A teaspoonful three times a day after meals is a proper dose for an adult. In the *apepsia* of infants, characterized by the presence of undigested aliment in the discharges, this combination is an excellent remedy. If a marked degree of acidity exist, the acid should be omitted, or given before the milk, when it may prevent the excessive production of acid. In *irritative dyspepsia*, when the pain and suffering are due to slow and imperfect digestion, lactic acid will often give great relief either alone or combined with pepsin. Cases of *acidity* and *heartburn* are often quickly relieved by lactic acid given *before meals.* When the presence of an excess of the *phosphates*, *uric acid*, and *the urates*, and of *oxalate* of *lime*, in the urine, is due to imperfect digestion and faulty assimilation, as is frequently the case, lactic acid is serviceable, and its utility is solely due to the good effect it has in promoting digestion. Over the other forms of these so-called diatheses it has no influence.

Lactic acid has been used with varying success in the treatment of *diabetes.* The object to be gained is the prevention of sugar formation from the starchy and other elements of the food. Dr. Foster reports some cases apparently decidedly benefited and Dr. Ogle gives an account of two cases in which no good results were attained. Cases have been lately reported in which the patients were improved by the use of lactic acid, but on the whole the utility of this agent in diabetes must be held to be as yet *sub judice.*

Disappointment in the use of lactic acid is frequently experienced from the poor quality of the drug.

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ACIDS.

Mineral.—*Acidum Sulphuricum.*—Sulphuric acid; specific gravity, 1.843.

Acidum Sulphuricum Dilutum.—Dilute sulphuric acid. (Sulphuric acid two troy ounces, water to a pint.) Dose, five to twenty drops well diluted.

Acidum Sulphuricum Aromaticum.—Aromatic sulphuric acid, elixir of vitriol. (Sulphuric acid six troy ounces, ginger a troy ounce, cinnamon a troy ounce and a half, alcohol two pints.) Dose, five to thirty drops well diluted.

Acidum Sulphurosum.—Sulphurous acid; specific gravity, 1.035.

Acidum Muriaticum.—Muriatic or chlorhydric acid; specific gravity, 1.160.

Acidum Muriaticum Dilutum. (Muriatic acid four troy ounces, water to a pint.) Dose, five to twenty drops well diluted.

Acidum Nitricum.—Nitric acid; specific gravity, 1.420.

Acidum Nitricum Dilutum. (Nitric acid three troy ounces, water to a pint.) Dose two to fifteen drops well diluted.

Acidum Nitro-Muriaticum.—Nitro-muriatic acid. (Nitric three troy ounces, muriatic five troy ounces.)

Acidum Nitro-Muriaticum Dilutum. (Nitric acid one and one-half troy ounce, muriatic two and one-half troy ounces, water to a pint.) Dose, two to fifteen drops well diluted.

Acidum Phosphoricum Dilutum.—Specific gravity, 1.056. Dose, two to fifteen drops in water well diluted.

ANTAGONISTS AND INCOMPATIBLES.—Alkalies and their carbonates, salts of lime and lead.

SYNERGISTS.—Bitters.

By assisting digestion and by correcting an abnormal condition of the alimentary mucous membrane, acids directly contribute to the blood-forming process, and indirectly, through the blood, to the construction of tissue, and the bettering, in general, of the bodily condition.

PHYSIOLOGICAL ACTIONS.—The mineral acids grouped above agree in the general qualities of their actions, but differ in some particulars. They attack the living tissues with great energy, abstract the water and combine with the potash, soda, and lime bases. In virtue of this affinity for water and this power of combination with bases, they cause destruction of tissue and are called *escharotics.* Some of them are more powerful than others: thus, sulphuric and phosphoric acids penetrate more deeply than the others. Nitric acid stains the skin yellow; sulphuric acid carbonizes or blackens. Hence in cases of accident, or when these acids are used with criminal intent, it is very obvious at a glance which has been taken or given: nitric acid making a yellow stain of the face, lips, and mouth, and sulphuric carbonizing or blackening those parts. In the stomach they produce the same effects. When concentrated they destroy the mucous membrane of the mouth, epiglottis, œsophagus, and stomach. The systemic effects are those of the irritant and corrosive poisons. The appropriate remedies are chemical and mechanical: alkalies, magnesia, soda, lime, soap, to neutralize the acid; and eggs, milk, oil, etc., to protect mechanically the tissues. The depression of the powers of life which immediately follows the ingestion of a mineral acid should be treated by opium, nutrient and stimulating enemata, and the intra-venous injection of ammonia.

The mineral acids, when administered in medicinal doses, must on reaching the stomach act in accordance with their chemical position.

They will combine with the bases and form salts. Hydrochloric, and to a less degree phosphoric, aid digestion, acting as synergists to pepsin, and contribute to the formation of peptones. Sulphuric unites with bases to form insoluble sulphates, and precipitates the albuminous substances from their solution in the gastric juices; hence this acid, although for a brief period it improves digestion, soon disorders it. It is true of all the mineral acids that their long-continued use diminishes the production of acid gastric juice, and in this way after a time they cause the very troubles for the relief of which they were originally administered. An acid solution on one side of an animal membrane, and an alkaline solution on the other, is the condition most favorable to osmosis. Hence the introduction of an acid into the stomach with sufficient frequency and in sufficient quantity must impair the production of acid gastric juice. In practice this is found to be the case. The mineral acids are among the most diffusible substances known, and of these hydrochloric stands at the head. So much of these acids as do not enter into combinations in the stomach diffuses quickly into the blood, and the salts which they form by combination with bases follow the laws of diffusion according to their class. The acids, especially the hydrochloric, and next nitric, diminish the alkalinity of the blood, and in this way accomplish all that they are capable of doing as systemic remedies.

THERAPY.—Not much need be said of the use of the mineral acids in affections of the mouth and throat. Formerly they were much employed in the treatment of *mercurial* and other forms of *stomatitis*, *diphtheria*, *aphthæ*, *gangrene*, etc.

In using mineral acids in affections of the mouth, it should not be forgotten that they attack the enamel of the teeth. First, the animal matter adherent to the teeth is dissolved off, when the teeth are said to be "set on edge." The acid should be applied to the affected surface only, and the mouth should afterward be washed out with an alkaline lotion. Pure hydrochloric acid may be applied with a camel's-hair brush or on a bit of soft pine-wood to the gums in cases of sloughing from *mercurial stomatitis*, and to the ulcers of *stomatitis materna*, to *syphilitic mucous patches*, and to those painful ulcers of the mouth which occur periodically in some subjects affected with a peculiar form of indigestion. In the case of ulcers having their origin in stomach-disorder, the internal use of hydrochloric, nitric, or nitro-muriatic acid, is often extremely beneficial.

The local use of hydrochloric acid in *diphtheria*, so strongly urged by Bretonneau, is now rarely employed, for it is well known that the diphtheritic exudation will rapidly extend over an inflamed surface produced by the application of the acid, and the destruction of the exudation at one part does not prevent its extension and renewed formation.

Any of the mineral acids administered by the stomach should be well diluted, and to prevent injury to the teeth should be taken through a glass tube or a straw. The mouth should also be rinsed out after swallowing the acid.

The mineral acids are highly useful in certain stomach-diseases. In *atonic dyspepsia* hydrochloric acid should be given after meals, or better, lactic acid. It is highly probable that hydrochloric acid is produced during digestion by the reaction between chloride of sodium and lactic acid. A combination of the acid with pepsin, as already suggested, is preferable in these cases of atonic dyspepsia. When, in consequence of faulty digestion, acetic, lactic, and butyric acids are produced in the stomach from the starchy, saccharine, and fatty constituents of the food, the acids given after meals add to the distress of the patient.

To prevent the *excessive formation of acid*, whether due to the action of the gastric glands, or to abnormal fermentation of the starchy, saccharine, and fatty elements of the food, mineral acids are used with decided advantage, but they must be administered before meals. For this purpose, hydrochloric or phosphoric acid is to be preferred. The excessive production of acid is manifested by *acid eructations*, *pyrosis*, *heartburn*, and *ulcerative stomatitis*.

There is a form of indigestion characterized by eructations of offensive gas, painful digestion, a sallow complexion, and by the appearance of oxalate-of-lime crystals in the urine, and is accompanied by mental despondency. This state of things is relieved by the nitro-muriatic acid.

The experience of English physicians practising in India has been favorable to the use of nitro-muriatic acid in *chronic hepatic affections*, and in *dysentery* and *dropsy* of hepatic origin. Acute diseases of the liver, and such chronic affections as *cirrhosis* and *waxy degeneration*, are not as a rule benefited by the mineral acids. *Mucous duodenitis* and *catarrh of the gall-ducts accompanied by jaundice*, and *jaundice of malarial origin*, are forms of hepatic disease in which nitro-muriatic acid is serviceable. With the internal use of the acid should be conjoined the local use to the right hypochondrium of the acid-bath. Three ounces of nitro-muriatic acid to a gallon of water is a suitable strength for the topical use in this way. The feet may be placed in the bath, and the legs, arms, and abdomen, may be alternately sponged, when the skin is torpid and its secretion defective. The temperature of the bath should be about 96° Fahr. (Martin). Another mode of making topical application of the acid-bath is as follows: "Let a flannel roller of ten or twelve inches wide, and sufficient to encircle the body twice, be soaked in the fluid and then wrung so as to remain only damp. Apply this instantly to the body, covering it with a piece of oiled-silk to avoid damping the dress. It should be worn constantly, but should be changed, soaked, and wrung, morning and evening" (Squire). This is a very effective local application in the hepatic disorders mentioned above as amenable to the treatment by the mineral acids, and is serviceable in the first stage of cirrhosis. Dr. Scott, of Bombay, ascribes to the acid-bath the power to relieve the pain of hepatic colic, by causing the expulsion of the impacted calculus.

The mineral acids are very effective remedies in the treatment of *summer and colliquative diarrhœa.* Crapulous diarrhœa and dysentery are not benefited by them. The indications for their use are these: painless, watery evacuations, of a light color, alkaline in reaction. Hope's mixture, which contains nitrous acid, has long been used with success, in such cases. The formula is as follows: ℞. Acidi nitrosi, ʒj; tincturæ opii, gtt. xl; aquæ camphoræ, ℥viij. S. One-fourth to be taken every three or four hours. A mixture of this kind may readily be extemporized, in which the relative proportion of the acid and opium may be arranged according to the indications of the case. Sulphuric acid is more decidedly astringent than nitric and muriatic, and is, therefore, as a rule, to be preferred in diarrhœa. Bence Jones places them as regards their actions thus: Hydrochloric more promotes digestion; nitric acid, secretion; and sulphuric, astringency. Nitric and nitro-hydrochloric are, according to this view, better suited to stomach and hepatic disorders characterized by deficient secretion, and sulphuric is more appropriate for the relief of a relaxed state of the mucous membrane. A combination of aromatic sulphuric acid with opium is one of the most effective remedies we possess in the treatment of *summer diarrhœa* and *cholera.* Sulphuric acid may also be used with advantage in the treatment of *dysentery,* in combination with sulphate of magnesia. ℞. Magnesiæ sulphat., ℥j; acidi sulphur. dil., ʒij; morphiæ sulph., gr. j; aquæ, ℥iv. M. S. A tablespoonful every three or four hours. After the action of a saline laxative, Hope's mixture, or an extemporized prescription of a similar kind, may be used. When the mineral acids do not quickly improve the discharges, and lessen their frequency, and when they increase the tormina and tenesmus, they should be suspended. In the treatment of cholera, dilute or aromatic sulphuric acid may be given frequently, well diluted in full doses. Opium can be added at such intervals as may be indicated.

Mineral acids, especially the muriatic, are very serviceable in *fevers.* They were formerly classed as refrigerants, or cooling medicines, and were supposed to allay thirst and to diminish fever. Although these notions are no longer entertained, the acids are known to render an important service in fevers. They increase secretion of the mucous membrane, and thus relieve the dryness of the tongue and fauces. As in fevers the gastric juice is deficient in acids, digestion is materially aided by their administration. In typhoid fever, the acids restrain somewhat the exhausting diarrhœa, increase the digestive power, and remove or diminish the dryness of the tongue. It is probable that they exert an influence on the composition of the blood, beyond the increased activity which they impart to the primary assimilation. Hydrochloric acid is preferable in the treatment of fevers. It may often be advantageously in beef-juice.

In *scarlet fever*, hydrochloric acid is frequently combined with chlorate of potassa (producing euchlorine), but it is better administered alone in this disease. Besides the internal administration of the acid, it is often mixed with water and used as a gargle, or mixed with honey and applied with a brush to the throat. One part of acid to five parts of honey or ten of water is a strong enough solution for this purpose. In the other *eruptive fevers*, hydrochloric acid is serviceable to allay thirst, to increase digestion and to obviate the tendency to adynamia in these diseases. To children, the dilute hydrochloric acid may be readily administered in lemonade or in sirup of lemons.

There is no doubt of the value of the acids, especially the nitro-muriatic, in the treatment of *constitutional syphilis*. This remedy is not to be compared in efficiency with mercury and iodide of potassium, but in chronic cases saturated, so to speak, with these approved remedies, in which syphilitic patches persistently reappear in the mouth, nitro-muriatic acid often renders important service. It is undoubtedly true that constitutional syphilis has been treated successfully by the acids alone, but a very rigidly abstemious dietary has been enforced in these cases. It has already been shown that the denutrition method is of itself sufficient in some cases to relieve the organism of constitutional infection. How much of the result is to be ascribed to the remedy, and how much to denutrition, is not clear.

Nitric acid has been used with success in the treatment of *intermittent fever* by Hammond, Bailey, and others. In order to obtain a curative effect, it is necessary to give the acid in full doses every four or six hours. This acid is of great service, also, after an arrest of the paroxysms of intermittent by quinia to remove the hepatic congestion, and the changes in the glandular apparatus of the intestines, induced by the fever-movement. It may be advantageously combined with the bitters, or used instead of the aromatic sulphuric acid in the preparation of the officinal *infusum cinchonæ flavæ.*

The mineral acids have long been used with more or less advantage in the treatment of *phthisis*. Their utility obviously depends on the fact that they supply to the digestive fluids a material in which they are deficient in this disease. As Fenwick has shown, both pepsin and acid occur in quantity much less than normal in the gastric juice of phthisical subjects. The acid best suited for the treatment of the *indigestion of phthisis* is the officinal *acidum muriaticum dilutum.*

Nitric acid is one of the numerous remedies used in *whooping-cough*. It is frequently successful in shortening the duration of the disease, and moderating its violence; but it acts much more beneficially after the subsidence of the catarrhal stage. It should be given well diluted in sweetened water. *Chronic bronchitis* and *hoarseness produced by* *singing* are said to be relieved by ten-minim doses of dilute nitric acid.

The mineral acids, especially the hydrochloric, have lately been proposed as remedies for *acute rheumatism.* The unquestionable utility of the tincture of the chloride of iron in rheumatism lends support to this practice. It is highly probable that the mineral acids check the formation of lactic acid in the blood. Whatever may be the nature of the action, good results from the treatment have been reported (Dr. J. James Ridge).

Some of the accidents due to *lead* are prevented, and relieved when they occur, by sulphuric acid. Sulphuric-acid lemonade is used by workmen in lead-factories to prevent lead-poisoning. This is supposed to act by forming the insoluble sulphate of lead. Dilute sulphuric acid is also effective in the treatment of *lead-colic.* The *constipation due to lead* is relieved by a combination of sulphuric acid and sulphate of magnesia, and the lead-cachexia is much benefited by a prescription of sulphate of quinia, sulphate of iron, and dilute sulphuric acid. The effects of lead on the nervous system are not removed by sulphuric acid.

Sulphuric acid is sometimes very effective in *uterine hæmorrhage.* It has seemed to the author to be more useful in the case of hæmorrhage due to fibroid or polypus than the flow arising from other causes. Although sometimes prescribed for *pulmonary hæmorrhage*, it is not equal to other remedies. In *intestinal hæmorrhage* sulphuric acid acts directly in part, and is therefore serviceable. In *purpura* it sometimes acts happily.

The aromatic sulphuric acid has long been used to check *profuse sweating*, especially the *sweating of phthisis.* It is certainly serviceable in this condition, but objectionable because of the ill effects of the acid on the function of digestion. If used at all, it should not in any case be long continued.

Nitric and nitro-hydrochloric acids have also been used with advantage in such diseases of the skin as *lepra*, *impetigo*, *acne*, *erythema nodosum*, and others, in which the skin-affection is symptomatic of imperfect digestion and assimilation.

In certain morbid states of the urine, as the *phosphatic diathesis*, *oxaluria*, *alkalinity of the urine from disease of the urinary mucous membrane*, and *phosphatic calculus*, the mineral acids render important service. In chronic cystitis and phosphatic deposits, a very weak solution of nitric acid (gtt. j — ℥ j) may be injected with advantage. In using such injections it is to be remembered that the bladder is extremely intolerant, and hence they should be permitted to escape immediately. When *uric acid is in excess* in the urine from faulty digestion and assimilation, hydrochloric acid is often of great service: the excess of uric acid disappears because the foods are more perfectly prepared for admission into the blood.

Local or Topical Uses of the Mineral Acids.—Some allusions have been made to the local application of muriatic acid in diseases of the throat and of the acid-bath in hepatic affections. It will not be necessary to recapitulate on these points.

Nitric acid is one of the most efficient escharotics for the destruction of specific or unhealthy ulcers. It is the most frequently-used caustic for the destruction of *chancroid*, *sloughing*, or *phagedenic chancre*. A glass rod or bit of pine is dipped into the acid and applied, care being taken to penetrate to all the sinuosities of the sore. The surrounding healthy tissue may be protected from injury by the previous application of oil, and, when the acid has sufficiently penetrated, its further action may be arrested by some alkaline wash. A water-dressing, or spirit and water, or dilute tincture of benzoin, or some similar application, may be afterward applied to the sore. Ordinary indurated chancre does not require escharotic applications. *Hospital gangrene*, or a *gangrenous condition* of wounds, injuries, or ulcers, is similarly treated with advantage, and probably no form of caustic is more desirable than nitric acid for these purposes. Ordinary *torpid* and *ill-conditioned ulcers* are improved and put in the way of healing by frequent washing with a weak lotion of nitric acid (℥ j—Oj). The same solution will remove *mucous patches* and *condylomata*, and will often check the bleeding from *hæmorrhoids*.

Nitric acid is one of the means employed for the removal of *hæmorrhoids*. It is not effective, however, against all forms. Large hæmorrhoids are much better treated by the ligature, galvano-caustic loop, or other radical measures. The so-called "strawberry-pile," a small hæmorrhoid of red color, which consists of a congeries of arterial twigs, and which bleeds freely, can be effectually destroyed by nitric acid. The pile should be exposed, usually through a speculum, and the strong nitric acid be applied on a pine-stick freely, followed by an abundant application of olive-oil to prevent the extension of the escharotic action to the surrounding parts. Small, superficial *nævi* are treated successfully in the same way.

Sulphuric acid penetrates more deeply than nitric, and its escharotic action is not so easily limited; hence, it is not so frequently employed for the destruction of sloughing and ill-conditioned ulcers. It is some times used in the form of Ricord's paste to chancres, sloughing, or phagedenic. The paste is made by the addition of sufficient charcoal to strong sulphuric acid to give it the proper consistence. This is spread on a piece of muslin of a size equal to the sore, and is allowed to remain on until an eschar is produced, when an ordinary poultice may be applied.

A favorite liniment of Sir Benjamin Brodie for counter-irritation of diseased joints is made by the addition of sulphuric acid to olive-oil (ʒ j of the acid, ℥ iv of olive-oil).

A general bath in, or sponging the body with, a solution of nitro-muriatic acid—one ounce to a gallon—is very serviceable in the case of cachectic children who present these symptoms: a dry and wrinkled skin, sallow complexion, capricious appetite with a taste for dirt-eating, and whitish, pasty motions. Applying to the surface of the body an acid solution must affect the constitution of the blood, for an acid solution on one side of an animal membrane and an alkaline fluid on the other are the conditions most favorable to osmosis.

Lately, Dr. Lombe Atthill, of Dublin, has called attention to the "use of nitric acid in the treatment of uterine disease." He applies the fuming nitric acid to the interior of the uterine cavity after previous dilatation with sponge or laminaria tents. In order to protect the cervix and cervical canal he introduces an intra-uterine speculum with expansible blades. The cavity is first mopped out and dried with cotton; then a probe, wrapped with cotton, is dipped in fuming nitric acid and applied thoroughly to the mucous membrane. This practice is very effective in the treatment of intra-mural fibroids and fungous granulations, to restrain hæmorrhage, and after the removal of polypi. He almost invariably employs nitric acid in the treatment of granular cervicitis and endo-cervicitis, "with the best results." When decided tenderness of the uterus exists, he advises that this be first removed by suitable measures.

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OILS AND FATS.

Adeps.—Lard. *Saindoux*, Fr.; *Schweineschmalz*, Ger.—Below the temperature of 90° Fahr. a soft solid.

Sevum.—Suet. *Suif de mouton*, Fr.; *Schöpsentalg*, Ger. The prepared suet of *ovis aries.*

Oleum Amygdalæ expressum.—Almond-oil. *Huile d'amandes*, Fr.; *Süsse Mandeln*, Ger. The fixed oil obtained from the kernel of the fruit of the *Amygdalus communis.*

Oleum Theobromæ.—Cacao-butter. *Beurre de cacao*, Fr.; *Kakaobohnen*, Ger. The concrete oil of the kernels of the fruit of *Theobroma cacao.*

Oleum Lini.—Flaxseed-oil. *Huile de lin*, Fr.; *Leinöl*, Ger. The fixed oil obtained from *Linum usitatissimum.*

Oleum Olivæ.—Olive or sweet oil. *Huile d'olive*, Fr.; *Olivenöl*, Ger. The fixed oil obtained from the fruit of *Olea Europæ.*

Composition.—The above-mentioned oils and fats differ in the quantity of oleine, stearine, and margarine, which they respectively contain, and hence differ in physical qualities. Lard is composed of 38 per cent. of stearine and margarine and 62 per cent. of oleine, and olive-oil of 72 per cent. of oleine and 28 per cent. of margarine. The more solid fats, as suet, contain much stearine. These neutral fats are, chemically, combinations of an acid (stearic, palmitic, margaric, oleic) with a base, glycerine. The oleine of linseed-oil appears to differ from ordinary oleine by furnishing a different acid—linoleic—when saponified.

Oleum morrhuæ.—Cod-liver oil. *Huile de morue*, Fr.; *Leberthran*, Ger. The fixed oil obtained from the liver of *Gadus morrhuæ* and other species of *Gadus.*

Composition.—Cod-liver oil contains a peculiar principle, *gaduin*, and yields, by distillation with ammonia, *propylamin.* It also differs from the fats and oils above described in containing various biliary principles and traces of iodine, bromine, phosphorus, sulphuric and phosphoric acids, lime, magnesia, soda, and iron. It agrees with the other oils in being composed for the most part of oleine and margarine. It is the latter constituent which gives the white cloudiness of cod-liver oil in cold weather, and which is, by the "British Pharmacopœia," directed to be separated by artificial cooling. According to Winkler, cod-liver oil does not yield glycerine, but oxide of propyl, when saponified.

There are three varieties of oil, due, not to differences in composition, but to modes of preparation: the *pale*, the *light-brown*, and the *dark* oil. The pale oil is freest from the products of decomposition and empyreuma, and is the best for internal administration.

In order to obtain more positive therapeutical results, certain medicinal substances are frequently added artificially to the cod-liver oils of commerce. Iodine, bromine, phosphorus, and iron, are thus added. Not only are such compounds bad, chemically considered, but the addition of such ingredients gives great opportunities for sophistication, and impure brown and other fish-oils may be substituted for the pure cod-liver oil.

It has been supposed that any oil or fat, even glycerine, may be used in place of cod-liver oil, and cream has been prescribed in this belief. Linseed-oil has been considered to have some special efficacy in wasting diseases, more particularly in phthisis, because of the large amount of vegetable albumen which it contains. These notions are erroneous. Cod-liver oil has special therapeutical virtues because it contains gaduin, propylamine, the constituents of bile, iodine, phosphorus, bromine, etc., in addition to the ordinary ingredients of an animal fat.

PHYSIOLOGICAL ACTIONS.—An oil or fat applied by friction to the epidermis will disappear, and, as a positive gain may thus accrue, it is reasonable to suppose that not only absorption, but assimilation, also, has taken place.

Fat plays an important part in the metamorphosis of animal fluids. As was long since shown by Lehmann, a small quantity of fat is essential to the digestion of nitrogenous articles of food. Cod-liver oil, as well as other oils, when taken in the proper quantity, has the power to facilitate gastric digestion, and therefore promotes the appetite. Oil is a very important material in intestinal digestion—constitutes the molecular basis of the chyle, which consists chiefly of finely-divided fatty matter, each globule of fat being surrounded by a thin layer of albumen. The fat taken in with the food undergoes the emulsionizing process, chiefly in the small intestine, and by the aid of the pancreatic and biliary secretions. Cod-liver oil is, above all other fats, adapted to form the molecular basis of the chyle. All fats do not penetrate into the veins and lacteals with the same facility, and the presence of certain substances is necessary to the process. Fats are not crystalloidal but colloidal substances, and have, therefore, but a feeble power of osmosis; but, notwithstanding this fact, the blood of the portal vein is much richer in fat than the blood of the arteries and systemic veins. The osmose of fats is accomplished by the action of the bile. It was long since shown, by Wistinghausen, that in capillary tubes moistened by bile, oil will rise much higher than in tubes not so moistened, or when moistened with water or a saline solution. He also showed that oil will pass through membrane saturated with bile much more readily than through similar membrane saturated with water. It has been ascertained that, in dogs with biliary fistulæ, the amount of fat in the chyle is much below the normal, and in the fæces much greater than normal (Day). Hence it must be concluded that the presence of bile is necessary to the absorption of fats, and that cod-liver oil must be peculiarly adapted to form the molecular basis of the chyle. It is for these reasons that, during a course of cod-liver oil, the body-weight is increased, the red blood-globules become more numerous, and a greater amount of fat is deposited in the tissues. It promotes the constructive metamorphosis. The important *rôle* performed by the oils and fats in the organism is shown by a variety of considerations. Wherever tissue-changes, physiological or pathological, are taking place, fat accumulates and enters largely into the formation of the resulting products. Newly-formed plasma contains much free fat, and all plastic exudations more than the non-plastic (Lehmann). Fat is the most abundant constituent of pus.

Food is intended ultimately for two objects: first, to build up the tissues in the growing state and to reconstruct the tissues wasted by use; second, to supply force, nervous, muscular, and digestive, to the different parts of the organism requiring it. The part performed by the fats is important as regards both objects. As already stated, they are essential to the construction of tissue; modern researches have shown that they have a necessary office in the evolution of force. The well-known experiment of Fick and Wislicenus demonstrated that, on a diet of hydro-carbons, great muscular effort can be undergone with but little destruction of muscular tissue, and without increased urea-discharge. Turkish porters, who are remarkable for their great muscular strength and endurance, live on a diet composed of fat and rice. The acrobats of Japan, who live on a similar diet, grow to an enormous size, and accomplish feats of strength and agility to which the athletes of Western nations are hardly equal.

If a muscle is made to contract under a bell-jar, an extraordinary evolution of carbonic-acid gas takes place, just as in violent muscular exercise the amount of carbonic-acid gas exhaled from the lungs is increased.

THERAPY.—Oils and fats are used by inunction in the treatment of the *scaly skin-diseases.* In this case, the normal amount of oil in the skin being deficient, it is supplied artificially.

Inunctions of oil or fat promote constructive metamorphosis in such chronic wasting diseases as *phthisis*, *scrofula*, *chronic dysentery*, etc. The best oil for this purpose is cod-liver oil, but, as it stains the skin yellow and has a disagreeable odor, it is often strongly objected to. Sevum or suet may be used and may be perfumed to the taste of the patient. The best time for practising the inunctions is just before retiring. A warm bath should first be taken, and then from one to two ounces may be rubbed into the skin. A thick night-garment should be put on to prevent injury to the bedding.

Badly-nourished infants, *rickety*, or *scrofulous*, or suffering from *chronic intestinal disorders*, who have a dry and scaly skin, are often materially benefited by the tepid or warm bath, followed by inunctions of lard, suet, or almond-oil. *Chlorotic girls*, with or without disorders of menstruation, are improved in condition by the same means. *Spare women*, who wish to gain flesh and roundness of form, may have their wish gratified by warm baths and inunctions of oil. The improvement which results from this practice is partly due to the general gain in bodily nutrition.

Rubeola, *scarlatina*, *roseola*, *erysipelas*, and other febrile diseases, are benefited by oil inunctions. These applications are grateful to the patient; they allay the burning heat of the skin, and in this way diminish restlessness and excitement. It is said that inunctions of oil reduce the temperature, but the decline in fever-heat is probably the result of the calmative influence which these applications have over one of the chief sources of distress. Inunctions of oil have a special utility in the *desquamative stage* of *scarlet fever.* It is the author's observation that inunctions of oil are serviceable in *fevers* generally, when there is much heat of skin and high temperature, with restlessness. Cocoa-butter is the most elegant of these preparations for external use. In the infectious diseases, a little carbolic acid may be added to the inunction oil or fat, with the view of destroying disease-germs.

Those who experience frequent *catarrhal attacks*, and take cold on slight exposure, may have their susceptibility diminished by a daily application of oil to the whole surface of the body.

In many maladies, the patients experience a notable distaste for fatty food in any form. This is especially the case with *scrofulous* and *phthisical* subjects, and, as fat in some form is necessary to digestion, assimilation, and heat-producing, it is obvious that by the use of cod-liver oil an essential element of nutrition may be supplied in the best form. In cases in which there exists a condition of faulty assimilation of fats, cod-liver oil, by reason of the fact that it contains in intimate association the bile elements, is especially adapted to form the molecular basis of the chyle. In *scrofula*, *rickets*, and other disorders of the nutritive functions belonging to this group, cod-liver oil is the best remedy for promoting constructive metamorphosis.

After *scarlet fever* in many children, especially in those with strumous diathesis, there occur *discharges from the nose and ears*, *feeble digestion*, and *general emaciation.* These *sequelæ of scarlet fever* are best removed by the internal use of cod-liver oil.

As a remedy in *phthisis*, cod-liver oil holds the first place, but it is not adapted to all forms and all stages of that disease. It is especially a remedy for the chronic forms of phthisis—*fibroid lung* and *chronic tuberculosis*—and is not serviceable in caseous pneumonia and acute phthisis. It is more useful in the chronic forms of phthisis because these afford the time and opportunity to reconstruct the tissues of the body—to build up the tissues from the molecular basis of the chyle. Cod-liver oil is not well borne when there is much fever, and cannot be well assimilated when the stomach has undergone the alterations which belong to acute inflammatory affections. This remedy is too often prescribed without any reference to the condition of the patient's digestive functions. The power of the stomach and intestines to digest fat is limited, and, if the quantity which can be disposed of is exceeded, the patient is incommoded. Rarely is it proper to prescribe more than a teaspoonful three times a day, and few patients can digest a tablespoonful. As the secretion of gastric juice, bile, and pancreatic juice, takes place most abundantly during the digestion of food, the time for the administration of oil in phthisical cases is after eating. When it is not well borne, the digestion and assimilation of the oil may be aided by combining it with liquor potassæ, lime-water, the compound tincture of gentian, tincture of nux-vomica, or strychnia, or other correctives according to the indications in individual cases. When the oil is not well digested—although stomach disorder may not have occurred—and it is seen to float on the stools, it may be combined with ether, since Bernard has demonstrated that ether increases the production of pancreatic fluid.

If continued for a sufficient length of time, cod-liver oil is of the greatest service in *chronic bronchitis* and *emphysema.* It should be given in the same way and under the same conditions as in phthisis.

Chronic rheumatism and *rheumatic arthritis*, maladies for the relief of which cod-liver oil was first prescribed, when occurring under bad hygienic influences in cachectic subjects, may be much relieved by this agent. In addition to the internal use of the oil, it may be applied with advantage locally to the affected joints. This combined use of the oil, systemically and by local inunction, is to be commended in the so-called *rheumatic gout* with deposits about the joints. On the same principle, cod-liver oil is beneficial in cases of *strumous synovitis*, *caries*, and *necrosis* of bone dependent on a constitutional state. It does not have, it must be admitted, any direct influence over these morbid processes; but it enters most usefully into constructive tissue-metamorphosis.

As a reconstituent, cod-liver oil is a very useful remedy in certain chronic affections of the brain and nervous system. One of the most common conditions with which we have to deal in middle and advanced life, and also one of the most important as regards the integrity of the brain, is *atheroma of the arteries.* This condition is represented by increased hardness of the radial pulse, the *arcus senilis*, irregular action of the heart, giddiness, vertigo, partial loss of vision, and failure of the memory and other intellectual faculties. Used to obviate these degenerative changes, and to prevent failure in the nutrition of the brain, we have in cod-liver oil a remedy of real value. It should be given in small quantity, and continued for a long time. As a phosphorized fat plays an important part in the structure and functions of the cerebral tissues, we may imitate the processes of Nature and administer the phosphates, the hypophosphites, or the lacto-phosphate of lime, in combination with cod-liver oil. The author has seen excellent results from such a combined use of these agents. Dr. Anstie much insists on the use of fats, especially cod-liver oil, as a part of the diet of those suffering from *neuralgia*, *paralysis agitans*, *epilepsy*, *mercurial tremor*, and *chorea.* Dr. Radcliffe had previously pointed out the utility of fats and oils in the same affections, and all practical physicians familiar with the subject are now pretty well agreed as to the value of this practice. The special indications for cod-liver oil in these affections are faulty assimilation and a low condition of the nutritive functions. Fats and oils are, of course, contraindicated in these nervous disorders when they occur in plethoric and over-fed subjects, but such a state of things is exceptional.

In *diseases of the skin of strumous* origin, cod-liver oil is, as Dr. Tilbury Fox remarks, " our sheet-anchor." Among these diseases are *lupus*, *ecthyma*, *psoriasis*, *scleroderma*, etc. The constitutional state requiring cod-liver oil is a lowered condition of the assimilative functions dependent on the strumous cachexia. The local use of the oil is certainly advantageous in these cases. Dr. Hughes Bennett strongly recommends the free application of the oil to *favus* and *eczema impetiginodes.*

The condition of debility and faulty assimilation which results from the prolonged treatment of *syphilis* with mercury and iodine is frequently remarkably improved by cod-liver oil. The *syphilodermata*, when occurring in cachectic subjects, are benefited by a persistent use of the same remedy. With the internal use of the oil may be conjoined inunctions. These are especially beneficial in the *squamæ* of syphilitic origin.

MODE OF ADMINISTRATION OF COD-LIVER OIL.—As cod-liver oil is extremely repugnant to many patients, it is desirable to prescribe it in as agreeable a form as possible. Washing out the mouth with raw whiskey or brandy so far blunts the sensibility of the nerves as to permit the oil to be swallowed without difficulty as regards its taste. Quickly stirred up in a hot whiskey-punch, it may be swallowed without appreciation of the taste of the oil. It may be taken on beer, the oil covered with the foam, and carefully prevented touching the glass. A wine-glass may be thoroughly moistened with ale or beer, and the dose of oil just enveloped in the beer, when it may be tossed into the throat without perceiving the taste of the oil; or the oil may be taken in sufficient lemon-juice in the same way. It may also be taken in black coffee. A very good disguise is that of Carlo Paresi, by which it is made to have the odor and taste of coffee. To 400 parts of cod-liver oil are added 10 parts of animal charcoal, and 20 parts of ground roasted coffee. The mixture is digested in a water-bath at a temperature of 50° to 60° C. and after standing three days is filtered and put in well-stoppered bottles. It is said that 10 drops of chloroform to 100 grammes of the oil will render it palatable. One part of essential oil of Eucalyptus to 100 parts of pale oil makes a mixture in which the odor and taste of the oil are entirely extinguished. Two drachms of cod-liver oil may be mixed with a drachm each of compound spirits of lavender and brandy. Emulsions of cod-liver oil are now prepared with glycerine and yolks of eggs and suitably flavored. The various emulsions with lime are also much prescribed. Cod-liver oil saponified by lime has been brought forward by Prof. Van den Court, of Brussels, as a remedy of especial efficacy in phthisis. Lastly, cod-liver oil has been used instead of lard or butter in the preparation of rolls, which are readily eaten by children.

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PHOSPHORUS AND SOME OF ITS COMPOUNDS.

Phosphorus.—*Phosphore*, Fr.; *Phosphor*, Ger. A translucent, nearly colorless solid, resembling wax, without taste, but having a peculiar smell. Its specific gravity is 1.8.

Oleum Phosphoratum.—Phosphorus twelve grains, almond-oil one ounce. Dose, five to ten drops in mucilage. An oleum phosphoratum is also prepared by dissolving, by the aid of heat, a half-grain of phosphorus in an ounce of cod-liver oil. The dose of this preparation is one teaspoonful.

Pilulæ Phosphori.—Phosphorus one part, suet 100 parts. Three-grain pills. (Radcliffe.)

Tinctura Phosphori.—Phosphorus one grain, absolute alcohol five drachms, glycerine one ounce and a half, spirit of wine two drachms, spirit of peppermint two scruples. "Dissolve the phosphorus in the alcohol with a little heat; at the same time warm the spirit and glycerine together. Mix the two solutions while hot, and add the spirit of peppermint on cooling. Dose one-half to one drachm."

Tinctura Phosphori Æthereale.—Solution of phosphorus in ether. Dose five to ten drops in sirup. A solution of phosphorus in chloroform, or bisulphide of carbon, may also be prepared for internal administration. Pills of phosphorus may be extemporaneously made by mixing the bisulphide of carbon solution with some inert powder. The evaporation of the bisulphide leaves the phosphorus in a finely-divided state intimately incorporated with the powder.

Zinci Phosphidum.—Phosphide of zinc. Dose one-twelfth to one-quarter of a grain. It is best administered in pill-form made with conserve of roses.

Synergists.—Oils and fats favor the absorption of phosphorus, and should never, therefore, be employed in cases of poisoning by this agent. Arsenic, and in a feeble degree sulphur, are synergistic.

Antagonists.—Hydrated magnesia, lime-water, and powdered charcoal, limit or prevent the action of phosphorus on the tissues. Letheby was the first to note that the vapor of turpentine prevented the toxic action of the vapor of phosphorus, and that workmen employed in the match-factory at Stafford, who were protected by vials of turpentine worn about the neck, escaped necrosis of the maxillary bones and other deleterious effects. Dr. P. C. Andant next published cases indicating the antidotal power of turpentine, and M. Personne submitted the subject to experimental demonstration and confirmed the observations of Andant. As turpentine destroys the luminosity in the dark and arrests the escape of the vapor of phosphorus, M. Personne infers that it acts similarly as an antidote, that is, prevents the combustion of phosphorus in the blood and the consequent consumption of the oxygen. Numerous cases of successful use of turpentine in phosphorus-poisoning have been reported (Koehler, Sorbets, and others). The experiments of Höhler and Schimpf show that the *commercial* oil of turpentine is an effective antidote to phosphorus; that it prevents fatty degeneration of the tissues; that no free phosphorus can be found in animals experimented on, and that turpentine and phosphorus form in the stomach an innocuous compound resembling spermaceti. The common or commercial turpentine, and that which has been for some time exposed to the air, and is therefore rich in ozone, is the kind only which is efficient as an antidote against phosphorus.

In treating cases of poisoning, the contents of the stomach should be thoroughly evacuated. The best emetic for this purpose is sulphate of copper, since it has been shown by Eulenburg and Guttmann, and afterward by Bamberger, that phosphorus quickly combines with copper to form the phosphide, which is much less active than the phosphorus itself. After free emesis obtained by the use of sulphate of copper, an emulsion of hydrated magnesia with the common oil of turpentine should be freely used. To repair the damage to the blood, transfusion has been successfully employed by Jürgensen.

Physiological Actions.—The vapor of phosphorus excites irritation of the conjunctiva and bronchial mucous membrane. In ordinary medicinal doses it gives rise to an agreeable sensation of warmth in the stomach. As it undergoes rapid oxidation, much hydrogen is evolved, which while in its nascent state combines with a portion of the phosphorus, forming phosphide of hydrogen. Eructation of this gas, therefore, is one of the unpleasant effects of phosphorus administered by the stomach. The action of the heart becomes more frequent, the body temperature rises somewhat, the mental activity and the muscular power increase, the menstrual flow becomes more abundant, aphrodisiac effects are experienced, and the urine and sweat are more freely excreted.

In toxic doses, phosphorus causes violent gastro-intestinal disturbance. Phosphoric acid, the product of the oxidation of the phosphorus, having a strong affinity for water and ready diffusibility, attacks the mucous membrane with great energy. Violent epigastric pain, vomiting, and diarrhœa, are produced, and the systemic effects due to the action of a corrosive poison are superadded to the physiological effects proper of phosphorus.

A portion of the phosphorus taken into the stomach passes into the blood unchanged, most probably in combination with fatty matter (Husemann and Marmé). If in sufficient quantity, it causes rapid destruction of the red blood-globules, prevents the reaction of the fibrinogen on the fibrino-plastic substance, and thus sets up an acute hæmorrhagic diathesis. Hence the utility of transfusion as practised by Jürgensen in cases of phosphorus-poisoning. According to Lecorché, these results are due to the formation of phosphide of hydrogen and phosphoric acid. Death occurs more promptly when the phosphide is the active agent. Transudation of blood takes place from all the mucous surfaces. An acute fatty degeneration of the stomach, of the liver, of the heart and arteries ensues (Munk und Leyden, Ebstein, Habershon, etc.). At a later period this fatty degeneration extends to the voluntary muscular system, and even involves at last the involuntary. According to Wegner, the hæmorrhages which occur in the course of phosphorus-poisoning are due to fatty degeneration of the arterial walls. Icterus, which is a usual symptom, is probably dependent on the separation and solution of the hæmatine, or it may result from the steatosis of the liver (Ebstein).

Workmen exposed to phosphorus-vapor suffer from necrosis of the maxillary bones. Wegner has shown that phosphorus exerts an important influence over the nutrition of bones, causing periostitis and hypertrophy.

The symptoms referable to the nervous system may be nothing more than those common to irritant poisons. Generally, however, delirium, paralysis, coma, and convulsions, are produced (Caspar).

Phosphorus and its compounds increase the excretion of phosphates by the urine.

THERAPY.—The physiological action of phosphorus in small doses in increasing mental activity finds a therapeutical expression in the use of its preparations in cerebral disorders. It is indicated in pathological states dependent on anæmia, and contraindicated in vascular congestion and excitement. Cases of *wakefulness*, dependent on cerebral anæmia and exhaustion, are often remarkably benefited by phosphorus in the form of the pill or tincture. It does not procure sleep in the way that chloral and bromide of potassium do. By the use of it in suitable states we supply to the cerebral substance a material which it requires for the healthy performance of its functions. It acts most beneficially in the cases of wakefulness in which the nutritive functions of the body are wanting in activity. The *wakefulness of the aged*, accompanied with muscular cramps, feebleness of memory, giddiness and trembling of the voluntary muscles on exertion, is improved by the preparations of phosphorus. *Early decay of the mental powers*, associated with atheromatous changes of the cerebral vessels, and consequent impaired nutrition of the brain, is benefited by minute doses of this agent. In these states, occurring in the aged, it is better to combine with the phosphorus, or to administer simultaneously, cod-liver oil. The author has seen good results from such a combination in *paralysis agitans*. Large doses of the medicine in these disorders of advanced life are improper and unsafe. The best results are obtained from the persistent use of minute doses. M. Delpech has obtained excellent results from the use of phosphorus in *paralysis*. It is obviously adapted to cases of chronic character in which all acute symptoms have subsided. The paralytic symptoms which accompany *white softening of the brain* (local and circumscribed anæmia) have appeared to the author to be improved by the use of the phosphates, hypophosphites, and lacto-phosphate of lime.

The preparations of phosphorus are very serviceable in *neuralgia*. It is true Dr. Anstie, in his recent able work on neuralgia, expresses the opinion that "its utility is not very extensive or reliable." Radcliffe, Bradley, Broadbent, Mr. J. Ashburton Thompson, on the other hand, report cures in some obstinate cases. Mr. Thompson's experience indicates that large doses are necessary to effect a cure. In his own words: "I now invariably begin by giving $\frac{1}{12}$ of a grain every four hours, and this I conclude to be an average dose." The formula given under the title "Tinctura Phosphori" is Mr. Thompson's; each drachm of it contains $\frac{1}{12}$ of a grain of phosphorus. With this solution he has treated successfully thirteen cases of neuralgia. Dr. Broadbent has given phosphorus with advantage in "epileptiform vertigo," neuralgia, and "nervous breakdown from overwork."

We have no remedy at present more efficient in the treatment of *impotence* than phosphorus. In the physiological state, *priapism* is one of the results of its toxic action. It is, of course, adapted only to cases functional in character, and not to impotence from organic defect.

According to Dujardin-Beaumetz, phosphorus is useful in that very protracted and troublesome disease, *progressive locomotor ataxia*, or posterior spinal sclerosis. Although the author has not observed any instances of cure of this affection by phosphorus, he has witnessed in a few instances decided amelioration.

Phosphorus has lately been employed as a substitute for arsenic in the skin-diseases for which the latter is used—notably *acne*, *psoriasis*, *lupus*. The author has seen excellent results from the use of the compound sirup of the hypophosphites in *acne indurata*.

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PHOSPHITES AND PHOSPHATES.

PREPARATIONS.—*Comp. Syrupus Calcii, Sodii, Potassii, et Ferri Hypophosphitis.*—Compound sirup of the hypophosphite of lime, soda, potash, and iron. Dose, a teaspoonful to a dessert-spoonful.

Syrupus Calcii Lacto-phosphatis.—Sirup of the lacto-phosphate of lime. Dose, a teaspoonful. Lactic acid has the property of dissolving freshly-precipitated phosphate of lime.

Compound Sirup of the Phosphates.—Parish's chemical food. Each drachm contains two and a half grains of phosphate of iron and one grain of phosphate of lime.

Sodii Phosphas.—Phosphate of soda. Dose, one drachm to one ounce.

Calcii Phosphas Præcipitata.—Precipitated phosphate of lime. Dose, one to ten grains.

PHYSIOLOGICAL ACTIONS.—In the first edition of this work the *phosphates* were included in the same section with *phosphorus*. There is a strong argument in favor of this arrangement, based on the chemical reactions which ensue when phosphorus is introduced into the stomach.

Phosphorus has a strong affinity for oxygen, and compounds are quickly formed in the stomach. It is probable, however, that some phosphorus enters the blood uncombined. It is certain that the effects of phosphorus differ in character from the effects of any of its compounds. They agree in the property of aiding constructive metamorphosis, but differ widely in other respects.

PHYSIOLOGICAL ACTIONS OF PHOSPHATE OF LIME.—There is no part of the body which does not contain, or does not yield on incineration, phosphate of lime. It gives solidity to the osseous framework of the body, and, when too little is furnished during the growing period, rickets and *mollities ossium* are the result. The demand made on the system of the mother for the supply of this essential material for the growth of the osseous structure of the fœtus is so great that her fractured bones unite with difficulty. The bones of animals, fed on food deficient in phosphate of lime, soften. All the animal fluids contain this substance in solution : thus it is found in the blood, the saliva, the gastric juice, milk, urine, and in the intercellular fluid throughout the body. It accumulates wherever tissue-changes are rapidly taking place (Dusart). It is, obviously, very important to the nutritive processes of the body.

As phosphate of lime is to a limited extent soluble in lactic and hydrochloric acids, it is evident that, administered by the stomach, diffusion into the blood must occur. Large amounts cannot, however, be disposed of in this way; hence small doses must be as effective, in the treatment of the maladies for which it is prescribed, as large ones—for all in excess of the quantity soluble in the free acids of the stomach must pass off with the fæces or form intestinal concretions.

PHYSIOLOGICAL ACTIONS OF PHOSPHATE OF SODA.—This salt is soluble in water in the proportion of four per cent. Hence it may be given in solution, and will readily diffuse through into the blood. In the dose of one ounce it acts as a laxative. As it has a saline taste similar to common salt, it may be given in soup or other food. It increases the alkalinity of the blood, according to Böcker, by causing a retention of the chloride of sodium. Phosphate of soda diminishes the excretion of urea, in part, it is supposed, by hindering the retrograde metamorphosis of tissue, in part by its interference with the process of digestion.

Although it is held that the phosphate of soda hinders digestion, the author's experience is opposed to this view. In large purgative doses, undoubtedly, very considerable commotion is induced in the intestines, and in this sense any purgative is hurtful to digestion. In the small doses required in most of the maladies for which this remedy is prescribed, no impairment of digestion occurs. Furthermore, by removing morbid states of the mucous membrane, the digestive function is directly promoted, by the proper use of the agent.

Therapy.—In cases of the so-called *bilious sick headache*, phosphate of soda is a most useful laxative. A permanent cure of this very troublesome malady may be wrought by regulation of the diet, and by the long-continued use of this remedy. It is not pretended that cases of *migraine*, due to an affection of the nucleus of the fifth, may be thus cured. A large proportion of these cases are produced by a catarrhal state of the gastro-intestinal mucous membrane, which the phosphate of soda has the power to remove. For the same reason, it is a remedy of the highest utility in cases of *jaundice* dependent on catarrh of the bile-ducts, this disease being secondary to the same process in the intestinal mucous membrane. In these affections the phosphate of soda should be administered in a drachm-dose (about one teaspoonful) three times a day, or more frequently. Children, who are frequently subjects of this disorder, do not require larger doses than ten grains to a scruple. In preventing inspissation of the bile and crystallization of cholesterine, and attacks of *hepatic colic*, the persistent use of the phosphate of soda is rarely unsuccessful. It is not pretended that this agent can relieve the attacks of hepatic colic, and, indeed, it is useless at these times. Many cases of this disease, if not most of them, originate in a catarrh of the duodenum, the transference of the catarrhal state by contiguity of tissue to the gall-bladder, and the formation of a nucleus of mucus and bile, about which the cholesterine crystallizes. Phosphate of soda has the property to prevent the occurrence of these changes, and consequently to prevent attacks of hepatic colic. The author has found one scruple to drachm doses, administered for several months before each meal, extremely efficacious in a number of cases of this kind. The value of Vichy in this and kindred affections probably depends on the phosphate of soda contained in this mineral water.

Many *ill-conditioned children* are found to pass *pasty and white stools*, showing the absence of bile, and are pale and ill-nourished notwithstanding an abundant supply of milk and a vigorous appetite. Ten grains of phosphate of soda, dissolved in the milk and given them several times each day, will often improve the intestinal digestion, change the appearance of the stools, and increase the nutrition of the body.

The phosphates are especially useful in diseases characterized by *mal-nutrition*. In *rickets*, *mollities ossium*, *delayed union of fractures*, *early decay of the teeth in children*, *caries and necrosis of bone*, in which the phosphate is needed to the repair and growth of the osseous structures, they may be supplied artificially. The phosphate of lime may be administered alone in these states, but is to be preferred in the form of the sirup of the lacto-phosphate, or of Parish's phosphates. As a large consumption of the phosphate of lime takes place during suckling, the *anæmia of the nursing mother* may be most advantageously treated with the lacto-phosphate of lime or phosphates. The waste caused by *suppuration*, *carbuncles*, *mammary abscesses or boils*, may be best repaired by the same means. The constitutional cachexia produced by *chronic bronchitis* with profuse expectoration, *leucorrhœa* and similar exhausting discharges, may be much improved by the phosphates, and with the general improvement of the bodily state there usually takes place an arrest in the local morbid process.

The explanation of the therapeutical action of the phosphates in the diseases just mentioned is equally true of their use in *phthisis.* The utility of the *hypophosphites* in this disease is not any greater, for it is probably true that these preparations undergo oxidation in the stomach and pass to phosphates. The compound sirup of the hypophosphites is an agreeable preparation and is readily taken, and certainly proves serviceable in the more chronic forms of the disease. The lacto-phosphate, the phosphates, and the hypophosphites, are undoubtedly useful in *chronic phthisis, fibroid lung, chronic tuberculosis, emphysema,* and *dilated bronchi,* but no advantage can be expected from them in acute tuberculosis and caseous pneumonia. The utility of these preparations in these groups of maladies depends on their power to promote constructive metamorphosis. If they improve the appetite, promote digestion, and increase the body-weight, they do good; if they disagree with the stomach, they do harm (Bennett). Not unfrequently the sirup of the hypophosphites gives rise to distressing tormina. This may be obviated by combining with it dilute phosphoric acid—a combination very effective, therapeutically: ℞. Syrp. hypophos. comp., ℥ iijss, acid. phosphor. dil., ℥ ss. M. S. A teaspoonful three times a day. Such a combination may be advantageously given with cod-liver oil, after meals, in chronic phthisis. The addition of arsenic contributes very materially to the therapeutical effects of the lacto-phosphate, for example: ℞. Syrp. calcii lacto-phos., ℥ iv; liq. potassii arsen., ʒ j. M. S. A dessertspoonful *ter die.*

Late favorable reports regarding the curative effects of phosphorus and its compounds in *pernicious anæmia* have not been confirmed by the most recent experience.

Percy, who has distinguished himself by researches on phosphorus, prepares hypophosphorous acid by passing through a solution of phosphorus in oil, perfectly pure, and dry, oxygen. He maintains that hypophosphorous acid is the only preparation of phosphorus which should be employed in medicine.

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IRON AND ITS PREPARATIONS.

Ferrum.—*Fer*, Fr.; *Eisen*, Ger.

Ferrum Redactum.—Reduced iron. Ferri pulvis. A tasteless powder of an iron-gray color. Dose, gr. ss—gr. ij.

Ferri Subcarbonas.—Subcarbonate of iron. Precipitated carbonate of iron. A reddish-brown powder. Dose, gr. v—gr. xv.

Trochisi Ferri Subcarbonas.—Troches of subcarbonate of iron. Composition: Subcarbonate of iron, vanilla, sugar, and mucilage of tragacanth. Dose, one to five.

Ferri Oxidum Hydratum.—Hydrated oxide of iron. Kept in the form of a soft magma and used as an antidote to arsenic.

Pilulæ Ferri Compositæ.—Compound pills of iron. Composition: Myrrh, carbonate of sodium, sulphate of iron. Dose, one or two pills.

Pilula Ferri Carbonatis.—Pill of carbonate of iron, Vallette's mass. Composition: Sulphate of iron, carbonate of sodium, clarified honey, sugar. Dose, gr. j—gr. v.

Mistura Ferri Composita.—Compound mixture of iron. Composition: Myrrh, sugar, carbonate of potassium, sulphate of iron, spirit of lavender, rose-water. Dose, a tablespoonful.

Emplastrum Ferri.—Iron-plaster, strengthening-plaster. Composition: Subcarbonate of iron, lead-plaster, and burgundy pitch.

Ferri Phosphas.—Phosphate of iron. A bright, slate-colored powder insoluble in water. Dose, gr. ij—gr. v.

Ferri Pyrophosphas. — Pyrophosphate of iron. In apple-green scales, having an acidulous, slightly saline taste, and wholly soluble in water. Dose, gr. ij—gr. v.

Ferri Sulphas.—Sulphate of iron. In transparent, bluish-green crystals, which, on exposure to the air, effloresce and change color. Is wholly soluble in water. Dose, gr. j—gr. iij.

Ferri Sulphas Exsiccata.—Dried sulphate of iron. A grayish-white powder, soluble in water with the exception of a small residue. Dose, gr. j—gr. ij.

Liquor Ferri Subsulphatis.—Solution of subsulphate of iron. Monsel's solution. Composition: Sulphate of iron, sulphuric acid, nitric acid. An inodorous, sirupy liquid, of a ruby-red color, and of an extremely astringent taste without causticity. It mixes with water and alcohol in all proportions without decomposition.

Liquor Ferri Tersulphatis.—Solution of tersulphate of iron. Composition: same as preceding preparation, except the quantity of acid. A dark reddish-brown liquid, nearly devoid of odor, and of an acid and extremely styptic taste.

Ferri Chloridum.—Chloride of iron. In orange-yellow, crystalline pieces, very deliquescent, and wholly soluble in water, alcohol, and ether. Dose, gr. j—gr. ij.

Liquor Ferri Chloridum.—Solution of chloride of iron.

Tinctura Ferri Chloridi.—Tincture of chloride of iron. Composition: Solution of chloride of iron, alcohol. Dose, m. v—m. xx.

Liquor Ferri Nitratis.—Solution of nitrate of iron. A transparent liquid, having a pale amber-color. Dose, m. ij—m. v.

Syrupus Ferri Iodidi.—Sirup of iodide of iron. A transparent liquid of a pale-green color. Composition: Iodine, iron, sirup. Dose, m. x—m. lx.

Pilulæ Ferri Iodidi.—Pills of iodide of iron. Composition: Iodine, iron, sugar, liquorice, and gum-arabic. Dose, one to three pills.

Liquor Ferri Citratis.—Solution of citrate of iron.

Ferri Citras.—Citrate of iron. Dose, gr. ij—gr. v.

Ferri et Ammonii Citras.—Citrate of iron and ammonium. In garnet-red, translucent scales, having a slightly ferruginous taste, and readily and wholly soluble in water. Dose, gr. ij—gr. v.

Ferri et Ammonii Sulphas.—Sulphate of iron and ammonium. Ammonio-ferri alum. In octahedral crystals of a pale-violet color, soluble in one and a half part of water at 60°. Dose, gr. j—gr. ij.

Ferri et Ammonii Tartras.—Tartrate of iron and ammonium. In transparent garnet-red scales, which have a saccharine taste. It is slowly soluble in rather more than its weight of water, but insoluble in alcohol and ether. Dose, gr. ij—gr. v.

Ferri et Potassii Tartras.—Tartrate of iron and potassium. In transparent scales, of a dark ruby-red color, and wholly soluble in water. Dose, gr. ij—gr. v.

Ferri et Quiniæ Citras.—Citrate of iron and quinia. In thin transparent scales, reddish or yellowish brown. Taste ferruginous and bitter. Slowly soluble in cold, more readily in hot water, and not soluble in alcohol and ether. Dose, gr. j—gr. v.

Ferri et Strychniæ Citras.—Citrate of iron and strychnia. Contains one grain of strychnia to 100 grains of the compound. Dose, gr. j—gr. iij.

Ferri Ferrocyanidum.—Ferro-cyanide of iron, Prussian blue. A tasteless powder of a rich, deep-blue color, and insoluble in water. Dose, gr. iij—gr. v.

Ferri Lactas.—Lactate of iron. In greenish-white crystalline crusts or grains, of a mild, sweetish, ferruginous taste, soluble in forty-eight parts of cold water, but insoluble in alcohol. Dose, gr. ij—gr. x.

Ferri Oxalas.—Oxalate of iron; a lemon-yellow, crystalline powder insoluble in water. Dose, gr. ij—gr. v.

Besides the officinal preparations of iron, there are numerous unofficinal formulæ to which some attention must be paid. The following are the most meritorious of these:

Ferri Arsenias.—Arseniate of iron. A tasteless powder of a green color, insoluble in water, but soluble in hydrochloric acid. Dose, gr. $\frac{1}{16}$ r. $\frac{1}{8}$.

Syrupus Ferri et Manganesii Iodidi.—Sirup of the iodides of iron and manganese. Dose, ʒ j.

Mistura Ferri Aromatica.—Composition: Pale bark in powder, 4; calumba, in powder, 2; cloves, bruised, 1; iron-wire, 2; compound tincture of cardamoms, 12; tincture of orange-peel, 2; peppermint-water, 50; macerate the first four ingredients in the last one for three days, agitating occasionally, filter, add the tinctures, and make up to 50. Dose, ℥ j—ij (Squire).

Syrupus Ferri et Manganesii Phosphatis.—Sirup of the phosphate of iron and manganese. Dose, ʒ j.

Mistura Ferri Laxans.—Composition: Sulphate of iron, 2 grains; sulphate of magnesia, 1 drachm; dilute sulphuric acid, 3 minims; spirit of chloroform, 20 minims; peppermint-water to 1 oz. (Squire).

Tictura Ferri Acetat. Ætherea.—Ethereal tincture of the acetate of iron. Dose, m. x—ʒ j.

Ferrum Dialysatum.—Dialysed iron. This preparation is made by the process of diffusion, and is iron in the colloid state. It is odorless, without the styptic taste of the ferruginous preparations, does not blacken the tongue and teeth, is free from irritant action, and does not constipate. It is precipitated by sulphuric acid, by acids, and by various salts, but neither alcohol nor sugar. It will no doubt prove to be the best form in which to administer iron. Dose, m. v—ʒ i.

If any given preparation has a styptic taste, and acts on the tongue and teeth, it is not genuine.

Reduced iron is one of the most useful ferruginous preparations for internal administration, comparatively tasteless, and therefore easy of administration, and ready soluble in the juices of the stomach. The objection to its use is the occurrence of eructations, sulphuretted or phosphuretted, owing to the oxidation of the iron, the evolution of hydrogen, and the combination of the nascent hydrogen with sulphur or phosphorus.

The so-called subcarbonate of iron is really little more than the red oxide. In the officinal pilulæ ferri carbonatis, the oxidation of the iron and the loss of carbonic acid are prevented by the sugar. This preparation is very soluble in the stomach-juice and is readily assimilated. The troches of carbonate of iron are convenient for administration to children, who take them readily. The hydrated oxide of iron is solely used as the antidote to arsenic in solution. For remarks on its administration I have to refer the reader to the article on Arsenic. Corresponding to these carbonates are the pilulæ ferri compositæ, which contain iron in the form of the carbonate, sulphate of soda, and myrrh. The mistura ferri composita is also a solution of the carbonate, contains myrrh and sulphate of potash, with a sufficient quantity of the latter to form an emulsion which suspends the iron.

Of the phosphates the better preparation is the pyrophosphate, which is readily soluble, unirritating and easily assimilable. The sulphate is an active astringent, and is an efficient remedy. When prescribed in pillular form the dried sulphate should be used, as the sulphate in efflorescing destroys the cohesion of the mass. Of the several solutions intended for topical use, the liquor ferri subsulphatis, or Monsel's solution, is the best, as it is powerfully styptic without being corrosive. The tincture of the chloride of iron is most agreeably taken in the form of Creuse's tasteless preparation, which appears to be an efficient chalybeate without possessing the causticity of the pharmaceutical preparation. In the sirup of the iodide of iron and the sirup of the iodides of iron and manganese, sugar is used to prevent oxidation of the iron and the setting free of the iodine. In the iodide-of-iron pill the same result is obtained by sugar or gelatine coating.

Less irritating to the stomach, but probably less efficient as chalybeates, are the combinations of iron with vegetable acids. These may be administered dissolved in Rhine, Catawba, or sherry wine. An elegant mode of prescribing them is in effervescence—the citrates or tartrates dissolved in a solution of citric or tartaric acid, and poured into a solution of sodium or potassium bicarbonate—to be drunk in effervescence.

Antagonists and Incompatibles.—The carbonates are incompatible with acids and acidulous salts and vegetable astringents; the citrates and tartrates with mineral acids, alkalies and their carbonates, tannic acid; the iodides with acids, acidulous salts, alkalies and their carbonates, lime-water, vegetable astringents; the tincture of the chloride, with alkalies and their carbonates, lime-water, carbonate of lime, magnesia and its carbonate, and astringent vegetables turn it black.

Synergists.—All agents promoting constructive metamorphosis are synergistic to iron, especially animal aliment, the simple, aromatic, and astringent bitters, cinchona, manganese, bismuth, etc.

Physiological Actions.—Although metallic iron is inert, yet in the stomach it enters into combination dissolved in the acids, and then acquires molecular activity. As a result of its oxidation in the stomach, hydrogen is liberated, which in its nascent state combines with sulphur, forming sulphuretted hydrogen. In part, iron is absorbed by the stomach, probably as an albuminate; in part, in the intestinal canal. The stools under a course of iron become brownish and even black, a result which indicates that a part of the metal taken fails to be absorbed; but, since it has been shown that, whether taken by the stomach or injected into the blood, elimination takes place by the intestinal canal, it remains uncertain how much is excreted or is merely discharged unaltered in the fæces.

Iron is not a substance foreign to the organism. Chemical analysis has demonstrated its constant presence in the blood, in the gastric juice, chyle, lymph, bile, in the pigment of the eye, and in traces in the milk and urine. According to Gorup-Basanez (analysis of C. Schmidt), the blood of man contains one part of iron to 230 of red globules, and that of beef one part of iron to 194 of red globules. Iron exists in combination in hæmatine; according to some in the state of oxide, according to others as metallic iron. That it performs a very important office is shown in the rapid construction of red blood-globules, when iron is administered in anæmia. Without it hæmatine is not formed, and the red globules diminish in number. By its medicinal use we furnish to the blood a material which it needs. In health a mixed diet contains sufficient iron for all the purposes of the economy. The blood being improved in quality by the administration of iron, the tissues are better nourished, and all the functions are performed with more vigor.

The physiological action of iron is not limited merely to the construction of red blood. When there is no intolerance to its presence in the stomach, it promotes the appetite and invigorates the digestion. By increasing the disposition for food and the ability to dispose of it, iron acts as a stomachic tonic. Hence, when given in the healthy state, or when administered for too long a period in disease, the gastric glands become exhausted by over-stimulation, and then it is said the iron disagrees. Being a restorative, its use is contraindicated in a condition of plethora, especially when there exists a tendency to hæmorrhage, or when there is reason to suspect an atheromatous state of the cerebral vessels.

In large doses the soluble preparations of iron give rise to nausea and vomiting. Some of them possess more or less toxic activity; the persalts are more active than the proto-salts. The iodide and chloride, the nitrate and sulphate, are the most active, death having ensued from the tincture of the chloride in one case (Christison), and alarming symptoms having occurred in others (Taylor).

Certain of the salts of iron, the sulphates, the nitrates, the chlorides, possess a high degree of astringency. Hence they produce constipation when taken internally. Brought into contact with blood, they coagulate it, forming a tough, brownish magma; and, as the albuminous elements of the tissues are also solidified, they are powerful hæmostatics.

Iron is eliminated by several channels. Its passage down the intestinal canal and exit by this route have already been alluded to. As the experiments of Lussana have shown, a large part of the iron which enters the portal circulation is eliminated by the liver in the bile. On the other hand, the chief part of the iron which is made to enter the systemic circulation is eliminated by the kidneys. Much of that which is absorbed from the intestinal canal enters the capillary system of the liver, diffuses through into the bile, and but a small part finally enters the systemic circulation.

The acid and astringent preparations of iron act on the teeth with considerable energy, as the experiments of Dr. Smith (of Edinburgh) prove.

The tincture of the chloride and the sulphate are more corrosive than the wine, and of course are more injurious than the compounds of iron with the vegetable acids.

THERAPY.—Iron-spray—a weak solution of the liquor ferri subsulphatis (ʒ j—℥ viij)—is very serviceable as an astringent in obstinate cases of *epistaxis*. The nozzle of the delivery-tube of the spray-douche should be inserted just within the anterior nares, and the spray be driven with considerable force. The same application is beneficial in *chronic coryza*, but the objection to its use is the danger of coloring the teeth. In *pulmonary hæmorrhage*, the same application made to enter the throat with the inspired air will often arrest the flow of blood; and this, notwithstanding so little iron can pass the chink of the glottis.

The subsulphate and pernitrate solutions are the most efficient remedies for arresting *hæmatemesis*. They should be given in small doses—one or two drops, well diluted with ice-water, and frequently. In the absence of these, the tincture of the chloride may be used in the same way. In *intestinal hæmorrhage* the astringent preparations of iron are much less beneficial, if, indeed, they serve any useful purpose—for they are converted into inert sulphides as they descend the canal. The author has seen the intestinal hæmorrhage of typhoid fever much increased by the rectal injection of a solution of Monsel's salts. The *bleeding from hæmorrhoids* may be much diminished and even arrested by washing the tumors, when they protrude, with the solution of the subsulphate. After the application of the iron, the tumors should be well oiled before returning them into the rectum. The solution of the pernitrate of iron has been very efficacious as an astringent in *chronic diarrhœa and dysentery*, in that known as the army diarrhœa. These diseases, as they occur in civil practice, may sometimes be arrested by this agent, but not usually, in the author's experience. A solution of the tincture of iron is one of the numerous remedies used to destroy the *ascarides vermiculares*—the thread-worms which infest the rectum. As the development of these parasites is favored by the anæmic state, it is good practice to conjoin with any local treatment the internal use of iron, notably the sirup of the iodide.

Iron is frequently given with advantage to promote *appetite and digestion* merely. Indeed, it is the opinion of some eminent authorities that the chief use of iron as a remedy, even in anæmia, is to promote the digestive function. For the purpose of increasing appetite and energizing digestion, the sulphate is the best chalybeate, unless, indeed, the mucous membrane prove intolerant. When digestion is feeble, and the intestinal movements sluggish, it is often advantageous to combine aloes with iron, as in the officinal aloes-and-iron pill, or with sulphate of magnesia, as in the mistura ferri laxans, the formula for which has been given.

The condition most usually requiring iron is *anæmia*, a deficiency not only of the hæmatine but of the red corpuscles. Iron is given in this state with the view of supplying to the organism a material in which it is deficient, and in this way promoting the construction of the red globules. As, however, food, especially beef, is rich in iron, and as but a small amount of that administered is really assimilated, there is much reason for holding that at least an important function of iron in anæmia consists in its power to promote appetite and digestion. Practical physicians are familiar with the fact that iron improves but little, if at all, the condition of the anæmic, when it does not increase the desire for food and the ability to digest it. In anæmia, iron is given with two objects: to furnish a needed material to the blood; to increase the energy of the primary assimilation. To accomplish the first object, small doses—one or two grains—of reduced iron or of the carbonates, or some one of the combinations with vegetable acids, are most suitable. The second object is best attained by the more active astringent preparations, especially the sulphate and the chloride. Large doses of these are frequently well borne. When they disagree, other salts may be tried, but preference should be given to the most astringent preparation which the patient's stomach will tolerate.

In *chlorosis*, the good effects of iron are not so conspicuous as in anæmia, although they are allied states. During a course of iron in chlorosis, purgatives are now and then necessary. Better results are obtained from a combination of iron and arsenic, and iron and strychnia, than from iron alone. The arseniate of iron is an excellent remedy in chlorosis, but it must be given in larger doses than the posological tables authorize, for it is by no means so actively toxic as is commonly supposed. A good formula is the following: ℞. Ferri arseniat., gr. ij; ext. cinchonæ, gr. xij. M. ft. pil. no. xij. Sig. One three times a day after meals.

In anæmia and chlorosis, the iron should be taken after meals to be mixed with the food. The preparations of iron should not be continued too long; occasional intermissions in their use are necessary, otherwise the digestive organs become deranged, and the good effects are lost. Occasional purgation is useful, and acts in a way to favor the absorption and assimilation of the iron. Air and exercise should always, if practicable, be prescribed in a ferruginous course, for the assimilation of iron is directly favored by these hygienic influences.

The *anæmia of chronic malarial poisoning* is especially improved by iron. If enlargement of the spleen and engorgement of the portal circulation coexist, the use of the compound jalap-powder should precede the iron; or the latter may be combined advantageously with resin of podophyllin, as follows: ℞. Chinoidin, ℈ij; resinæ podophylli, gr. iv; ferri sulphatis exsic., ℈j. M. ft. pil. no. xx. Sig. One three times a day.

According to some, the pil. ferri carbonatis is preferable to the sulphate; it is certainly sometimes better borne. ℞. Pil. ferri carbonatis, ʒj; acidi arseniosi, gr. j; quiniæ sulph., ℈ij. M. ft. pil. no. xl. Sig. Two pills three times a day. In *enlarged spleen* of malarial origin, a combination of sulphate of iron with sulphate of quinine is generally preferred. ℞. Quiniæ sulphat., ʒj; ferri sulphat. exsic., ʒjss. M. ft. pil. no. xxx. Sig. One pill three times a day, or four or five during the day.

Although the preparations of iron are of little service in *leucocythæmia*, they are certainly in a high degree useful in *pseudo-leucocythæmia*, or cachexia of the spleen. In the latter disease the relative number of blood-corpuscles may be greatly reduced, but they can be increased in number and raised to the normal by the use of those materials needed by the blood-making organs, especially by the use of iron.

In *syphilitic cachexia*, the preparations of the iodide of iron possess a high degree of utility. In *sloughing phagedena*, or simple *chancroid*, the iodide is frequently prescribed when these accidents occur in debilitated constitutions. Some authorities prefer the tartrate of iron under these circumstances, but the iodide acts with more promptness and vigor. In the treatment of *constitutional syphilis*, the ferruginous preparations are only useful in so far as they may be applied to promote constructive metamorphosis. More commonly than is supposed by the advocates of special plans of treatment, tonic remedies, especially chalybeates, exercise a most favorable influence over the course and duration of syphilis. ℞. Iodoformi, ℈j; hydrargyri chloridi corrosiv., gr. j; ferri redacti, ℈j. M. ft. pil. no. xx. Sig. One pill three times a day. ℞. Iodoformi, chinoidin, ferri redacti, āā ℈j. M. ft. pil. no. xx. Sig. One pill three times a day.

Iron is one of the remedies most useful in the treatment of *acute rheumatism*. As was originally suggested by Reynolds, the tincture of the chloride is most serviceable. It is more especially adapted to the treatment of pale, delicate, and cachectic subjects, and is much less beneficial if not positively harmful, in the plethoric and overfed. Given in suitable cases, the tincture of iron, in doses of ♏. xx—xxx every four hours, diminishes the pain, fever, and sweats, lessens the chances of cardiac mischief, and hastens convalescence. By retarding waste and favoring excretion of uric acid through the kidneys, the duration of the disease is shortened and a tedious convalescence is prevented. We owe to Dr. Anstie the important suggestion that tincture of chloride of iron may be used successfully as a *prophylactic against acute rheumatism*. Here, again, the author must state, as a result of his personal observation, that such prophylactic treatment is very useful in weak and cachectic subjects and not applicable to the robust and full-blooded. The tincture of iron should be administered without delay in such weak subjects with a rheumatic history, when they complain of lassitude, muscular pains, sore joints, furred tongue, although they are yet free from fever and joint-swellings.

The treatment of *erysipelas* by large doses (m. x—ʒ j every four hours) of tincture of chloride of iron is now very generally adopted. It is questionable whether this practice is directly beneficial. Its utility depends chiefly on the support which it affords to the organism while laboring under a debilitating disease, and, as an abundant supply of aliment is prescribed with the iron, it is impossible to estimate in any given case how far the result may be attributable to the remedy.

Influenced by the same considerations, the tincture of iron is frequently prescribed in *diphtheria*, alone or in combination with chlorate of potassa. Although it possesses no special utility in this disease, it may serve as one of the means for maintaining the forces of the body, and in this way indirectly contribute to a favorable result. There is no advantage in applying the tincture of iron to the fauces in diphtheria ; it is not a solvent of the false membrane, and cannot prevent the spread of the exudation.

In the treatment of *scrofula*, *strumous enlargement of the cervical, inguinal, and mesenteric glands*, and in *rickets*, the preparations of iron occupy a most important place. In these affections the sirup of the iodide of iron is generally preferred, and excellent results are obtained from a combination of phosphate of iron and phosphate of lime, especially in rickets. In these cases, also, the sirup of the iodides of iron and manganese is indicated. Iron is one of the remedies most frequently prescribed in *chronic tuberculosis*, but it has no special influence over the deposition of tubercle. It helps to a better state of the blood-making process, and, by promoting the constructive metamorphosis, hinders the progress of the malady.

As *neuralgia* so often depends on anæmia, it happens that iron is one of the most frequently prescribed remedies for this disease. Anstie prefers large doses (m. xxx—xl *ter die*) of the tincture of the chloride, and 20-grain doses of the saccharated carbonate twice or three times a day.

In *disorders of the mind*, either dependent on or increased by an anæmic state, iron is often useful. In *chronic mania* and *melancholia*, when debility is present, iron is employed as a restorative agent. The ferruginous preparations are especially useful in the *anæmic forms of puerperal mania*, and in the *insanity* of *lactation*. Bucknill and Tuke prefer the tincture of the chloride in these affections.

Whenever *epilepsy* occurs in weak and anæmic subjects, iron is indicated. Cases of this disease, essential in character and dependent on cerebral anæmia, are sometimes cured by iron alone. The author has seen excellent results from a combination of bromide of iron and bromide of potassium in such cases: ℞. Potassii bromidi, ℥ j; ferri bromidi, gr. iv; aquæ, ℥ ij; syrup. simplicis, ℥ vj. M. Sig. A tablespoonful *bis die*.

Large doses of subcarbonate of iron have long been used with advantage in *chorea*. When the subject of this disease is distinctly anæmic, iron, in some of its forms, is unquestionably serviceable, and its utility is often increased by combination with purgatives. When anæmia is not present, arsenic is preferable to iron. Chorea arising from moral causes (anger, fright, etc.), and from pregnancy, is not benefited by iron. This remedy is especially adapted to the chorea of anæmic girls about the age of puberty.

The preparations of iron are of course inadmissible in acute affections of the respiratory organs, but, in certain of the chronic forms and stages of these diseases, some of the chalybeates are very useful. In *chronic bronchitis*, with free expectoration, the mistura ferri composita has long been used with advantage. At the present time the phosphate of iron, quinia, and strychnia, is generally preferred in *chronic bronchitis*, in the *chronic forms of phthisis*, in *emphysema*, and in *humid asthma*. Iron is contraindicated when pulmonary hæmorrhage exists or is threatened. A combination of tincture of digitalis and tincture of chloride of iron abates the temperature and diminishes the sweats of hectic fever. ℞. Tinct. digitalis, ʒiij; tinct. ferri chloridi, ʒv. M. Sig. Fifteen drops three or four times a day.

In *fatty degeneration of the heart*, the preparations of iron render important service, by improving the nutrition of the organ. The *palpitations*, the *murmur*, and *præcordial anxiety* which accompany cases of anæmia and chlorosis, are relieved by chalybeate medicines. In *dilatation of the cavities of the heart*, especially the right, accompanied by cough, difficult breathing and general dropsy, greater relief is sometimes experienced from the preparations of iron than by the so-called cardiac sedatives and diuretics. In these cases, as also in *mitral regurgitation*, the distress of the patient increases with increasing thinness of the blood, and is diminished by those remedies, such as iron, which improve the quality of the blood. A combination of iron, digitalis, and squill, is sometimes extremely serviceable in these cases—for example: ℞. Ferri redacti, quiniæ sulphat., pulv. digitalis (English), āā ℈j; pulv. scillæ, gr. x. M. ft. pil. no. xx. Sig. One pill three or four times a day. Iron may be used with advantage to assist in the process of *compensation in valvular lesions*, when the condition is one of anæmia. Iron is contraindicated in all cases of cardiac disease occurring in those who are full-blooded.

In the passive forms of *hæmorrhage*—in *purpura*, the *hæmorrhagic diathesis*, *epistaxis*, *gastric*, *intestinal*, and *renal hæmorrhage*, when they are due to anæmia or favored by it—iron is unquestionably useful, and the preparation most generally applicable is the tincture of the chloride.

Derangements of the *menstrual function*, when associated with anæmia, more especially when produced by anæmia, are often removed by the use of chalybeate medicines. *Amenorrhœa* is, more frequently than to any other cause, due to anæmia of the ovaries, consecutive to chlorosis or general anæmia, and *dysmenorrhœa* may depend, in one of its forms at least, upon the same condition of the blood. *Menorrhagia* may also be one of the results of an impoverished state of the blood. Iron is the most appropriate medicament in these disorders. It is the judgment of Graily Hewitt and Barnes that "small doses of iron are generally the best" in amenorrhœa. Barnes prefers the solution of the acetate, and speaks favorably of the citrate of iron and ammonia, given in an effervescent state, and of the combination of iron and strychnia. The use of ferruginous preparations in menstrual disorders should be determined by the results of a careful differentiation of the causes. The absence of the uterus and ovaries, occlusion of the cervix, and various other conditions besides anæmia, should be eliminated, and the use of iron restricted to those cases in which an impoverished state of the blood is either the only factor or an influential one.

The injection of the various styptic solutions of iron into the uterine cavity, to arrest *post-partum hæmorrhage*, is now common practice. Notwithstanding the alleged innocuousness of this treatment, it is probable, as Snow Beck has shown, that fatal results have ensued from the incautious use of these injections. The officinal solutions of the perchloride and subsulphate have been thrown into the uterine cavity, with the effect to cause uterine thrombosis, followed by systemic infection. These solutions are much too strong; one part of Monsel's solution to three of water is sufficiently styptic, and is probably perfectly safe. The uterine cavity should be cleared of clots, and the nozzle of the syringe carried well up to the fundus, when the injection should be slowly delivered. The reader need hardly be reminded that this expedient is only proper after the usual means for securing uterine contractions have failed. The same plan of styptic injections has been used to arrest the *hæmorrhage from abortion*, but caution is necessary in these cases, for it is essential to safety that there be an open and patulous condition of the os, to permit escape of coagula. Similarly these injections are used to restrain bleeding in cases of *uterine fibroids*, *uterine cancer*, and in the *uterine hæmorrhage* dependent on spongy granulation of the mucous membrane. In every case of such use of styptic iron injections, it is essential, first, that air be not pumped into the uterine cavity, and second, that sufficient dilatation of the cervical canal exist to permit ready exit to the surplus fluid and coagula.

In *albuminuria*, connected with chronic changes of the kidney, iron is often very serviceable to improve the digestion, and to correct the anæmia, which is such an obvious feature of these maladies. The tincture of the chloride and the tincture of the acetate—especially the latter—are preferred, partly on account of their value as hæmatinic remedies, and partly because of their supposed diuretic action. When *spermatorrhœa* is dependent upon an impoverished condition of the blood, with relaxation of the vesiculæ seminales, the tincture of iron is useful, but it is rarely of itself sufficient to effect a cure. The chalybeates are only harmful in those cases of *nocturnal seminal losses* which in the robust are merely significant of plethora. In *gleet* occurring in anæmic subjects, and in the *prostorrhœa* and *catarrh of the urethra*, which arise from relaxation, the preparations of iron are useful adjuncts to other measures. ℞. Tinct. ferri chloridi, ʒ vj; tinct. cantharidis, ʒ ij. M. Sig. Fifteen drops in water, three times a day.

The sirup of iodide of iron is one of the most successful remedies in the *nocturnal incontinence of urine* in children. The precise indications for its use are not evident. Sometimes belladonna succeeds better. It appears to the author that the iodide of iron succeeds better in the case of pale, delicate, and strumous children, and belladonna better in those who are more robust, the condition in the former being one of atony of the muscular wall of the bladder, in the other too ready contraction from the reflex stimulation of acid urine. In these cases of incontinence of urine the sirup of the iodide should be given in doses of fifteen to twenty minims, well diluted with water, three times a day.

Local Uses.—The styptic preparations of iron are frequently used to restrain *hæmorrhage*. *Leech-bites* that bleed too profusely, *hæmorrhage* after *extraction* of *teeth* or in minor *surgical operations*, *oozing from a large wounded surface*, may often be checked by the use of Monsel's solution.

As a topical application in *gonorrhœa* after the acute symptoms have subsided, in *mucous cervicitis*, in *leucorrhœa*, the styptic preparations of iron are certainly useful, but a strong objection to their use arises from the staining of the clothing.

Monsel's solution is an effective application to *fissured nipples:* ℞. Liquor ferri subsulphatis, ʒ ij; glycerini, ʒ vj. M. Sig. Apply with a camel's-hair brush to affected parts. Pure solution of subsulphate of iron will arrest the growth and cause the exfoliation of *syphilitic vegetations* of the glans and prepuce.

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MANGANESIUM.

Manganese.—*Mangen*, Ger.; *manganèse*, Fr.

Manganesii Oxidum Nigrum.—Black oxide of manganese. **Dose,** gr. ij—gr. x. In pill or powder.

Manganesii Sulphas.—Sulphate of manganese. In colorless or pale rose-colored transparent crystals, freely soluble in water. Dose, gr. ij—gr. v.

Unofficinal preparations:

Syrupus Ferri et Manganesii Iodidi.—A pale straw-colored sirup. Dose, m. x — ℥ ss.

Ferri et Manganesii Carbonas Sacch.—A tasteless reddish-brown powder. Dose, gr. v—℈j.

Syrupus Manganesii Iodidum.—A sirup which corresponds in strength to the officinal sirup of the iodide of iron and may be given in corresponding doses.

Besides the above, a carbonate, phosphate, tartrate, malate, and lactate, have been proposed for use, but hitherto they have not attracted attention and are rarely employed. The officinal and unofficinal preparations named above are all that, according to the present state of professional experience on the subject, will ever be required. It will be most convenient, however, to include with the manganic preparations the following:

Potassæ Permanganas.—Permanganate of Potassa. In needle-shaped crystals, of a deep-purple color. It is soluble in sixteen parts of cold water, and the solution has a deep-purple to a rose-color, according to the state of dilution of the salt. Dose, gr. ss—gr. j. In prescribing the permanganate, distilled water free from organic matter should be directed.

PHYSIOLOGICAL ACTIONS.—The sulphate has an extremely disagreeable styptic and metallic taste; the black oxide less so, and the saccharated carbonate is free from any taste except that of the sugar. The preparations of manganese are somewhat irritant to the gastro-intestinal mucous membrane, and the sulphate is emeto-cathartic in full doses. There seems to be no doubt that the sulphate has a decided cholagogue effect, for very large discharge of bile is a result of its cathartic action. In *small* doses the manganic salts promote the appetite and digestive function. They probably enter the blood as albuminates. The intimate association of manganese with iron throughout the economy of Nature is exemplified in the human body. They are found together in the blood, hair, bile, biliary concretions, and renal calculi. The proportion of manganese to iron in the red blood-corpuscles is as one to twenty. As an essential constituent of the blood it undoubtedly has to do with the constructive metamorphosis of the body. Used in large doses and for a considerable period of time it produces effects analogous to those of zinc—progressive wasting and feebleness, a staggering gait and paralysis (paraplegia). In toxic doses, according to the researches of Laschkewitsch, it causes in animals death by convulsions. In smaller doses it diminishes the pulse-rate, lowers the action of the heart, and lessens the blood-pressure. Like phosphorus, manganese induces acute fatty degeneration of the liver. When it is injected into the veins of animals, it causes tetanic cramp, dilatation of the pupil, exophthalmus, and death, and after death the heart-muscle does not respond to electrical stimulation (Laschkewitsch).

ANTAGONISTS.—The preparations of manganese are not incompatible with the vegetable astringents. The salts of lead, silver, and mercury, and the caustic alkalies, are chemically incompatible with manganese.

SYNERGISTS.—Iron is synergistic as regards hæmatinic effects, and the salts of copper, silver, and zinc, as regards the effects on the nervous system.

THERAPY.—Although manganese has not of itself been very useful in the treatment of *anæmia* and *chlorosis*, yet there is no doubt that its combination with iron much increases the efficacy of the latter. Some of the preparations named at the head of this article, especially the saccharated carbonate of manganese and iron, may be usefully prescribed in these diseases. Cachectic states arising from *syphilis*, *cancer*, *struma*, *gout*, *prolonged suppuration*, *chronic malarial infection*, etc., are successfully treated by the sirup of the iodide of iron and manganese.

Gastrodynia and *pyrosis*, according to Dr. Leared, are relieved by 10 to 15 grain-doses of the black oxide—not the commercial article, but an oxide purified by washing with hydrochloric acid. In these disorders the effects of manganese are similar to those of bismuth (nitrate and carbonate), of zinc, and silver (oxide). Small doses of manganese (sulphate) may be usefully combined with iron and quinine when prescribed *to promote constructive metamorphosis.* ℞. Quiniæ sulph., ferri sulph. exsic., manganesii sulph. exsic., āā ℈j. M. ft. pil. no. xx. Sig. One pill three times a day. In *jaundice* of malarial origin, or from *catarrh* of the *biliary passages*, the author has seen excellent results from the use of manganese. ℞. Chinoidin, ʒj; manganesii sulph. exsic., ℈ij. M. ft. pil. no. xx. Sig. One three times a day in malarial jaundice. ℞. Fel. bovin. purif., ʒj; manganesii sulph. exsic., ℈ij; resinæ podophylli, gr. v. M. ft. pil. no. xx. Sig. One three times a day in catarrhal jaundice. In the *disordered digestion of gouty subjects*, and to restore the activity of the assimilative functions after attacks of gout, manganese is most serviceable.

Manganese (chloride) has been used by Osborne with success in *hæmorrhage* (*epistaxis*), and the sulphate is one of the remedies for *chronic rheumatism*, *neuralgia*, *cholera*, and *syphilis*.

An ointment of the oxide (ʒij—℥j adeps suil.) has been used with advantage in *tinea*, *scabies*, and other *chronic skin-diseases*. ℞. Manganesii oxid., sulphuris, saponis dur., āā ℥j; adipis suilli, ʒiij. M. Ointment for *porrigo*.

Actions and Uses of the Permanganate of Potassa.—This salt is a very powerful oxidizing agent, and yields up its oxygen readily in the form of ozone. Its use as an internal and external remedy is based on this chemical fact. That it parts with its oxygen so readily is held by some to demonstrate its entire inutility when administered by the stomach. Although it must instantly be decomposed on reaching the stomach, there are satisfactory reasons for believing that it exerts a favorable influence on certain diseases in which, theoretically considered, it may be indicated. The author has seen marked advantage from its use in the *dyspepsia* and *flatulence* so constantly attendant on obesity. It has also appeared to be very serviceable as a remedy for *an abnormal* and *excessive deposition of fat*. In the so-called *uric acid diathesis* it favors the conversion of uric acid into urea, and thus prevents the formation of uric-acid calculi. Pain in the lumbar region, frequent micturition, acid urine, much brick-dust sediment, and intestinal indigestion, are associated symptoms relieved by the permanganate. Under the same conditions, it is probable, *acute rheumatism* is developed, and to the action of the permanganate as an oxidizing agent is attributable the benefit which is sometimes obtained from its use in this disease. In *scarlatina* and *diphtheria* the permanganate is used with undoubted benefit, applied to the throat and taken by the stomach. In *erysipelas*, *puerperal fever*, *septicæmia*, it has been given with advantage. It is indicated as an internal remedy in the septic morbid states, and is certainly beneficial, whatever view may be entertained of its *modus operandi*. For internal use the permanganate is best administered in pure distilled water, and the bottle containing the solution should be glass-stoppered. The dose for internal use is gr. ¼—gr. j *ter die*.

The most important uses of permanganate of potassa are external and *disinfectant.* It is a *deodorizer* rather than a disinfectant. It is very frequently used (ʒj—Oj) to correct the fetor of *cancer*, *ulcers*, *caries*, *abscesses*, etc. It is used as an injection, or in the form of spray, to destroy the odor of the discharges and to alter the morbid action, in cases of *ozœna*, *otorrhœa*, etc. It is an elegant toilet preparation (gr. j—℥j) for destroying the *odor of a foul breath*, the *smell of the axilla*, and the *fetor of the sweat of the feet.* Its action is not lasting, and the effects must be maintained by frequent applications.

The permanganate of potassa in solution (gr. ij—℥j) is one of the numerous remedies prescribed in *gonorrhœa* and *leucorrhœa*, but it has no special advantages in these maladies.

When the permanganate is deoxidized it loses its rich purple color, becomes a dull red, and is reduced to the state of binoxide of manganese.

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CHALYBEATE MINERAL SPRINGS.

1. NORTH AMERICAN.

Bailey Springs, Lauderdale County, Alabama.

These springs contain carbonates of potassa, soda, magnesia, carbonic-acid gas, oxide of iron, etc.

Rawley Springs, Rockingham County, Virginia.

Carbonate of iron (0.203 grain) is the most important ingredient in these waters. They contain, also, carbonates of manganese, magnesia, lime, and lithia, and sulphates, etc.

Sweet Chalybeate Springs, Alleghany County, Virginia.

The name of this water is derived from its sweetish taste. It is highly charged with carbonic-acid gas, and contains sesquioxide of iron, with sulphate of lime (4.110 grains), sulphates of magnesia and soda, and chlorides of lime, sodium, magnesium, etc.

Rockbridge Alum Springs, Rockbridge County, Virginia.

Bath Alum, Bath County, Virginia.

These waters are remarkable for containing free sulphuric acid. They contain also sulphates of magnesia and lime, protoxide of iron, and carbonic-acid gas. The Bath Alum waters contain twice as much iron as the Rockbridge Alum.

Bedford Alum Springs, Bedford County, Virginia.

Similar in composition to the above, but contain a larger proportion of iron, and of the salts of potassa, magnesia, and lime.

Bedford Springs, Bedford County, Pennsylvania.

This water contains carbonate of iron (0.625 grains) associated with a large proportion of sulphate of magnesia (10 grains), and is, therefore, a laxative chalybeate.

2. EUROPEAN.

Bascombe, Bournemouth, Hampshire, England.

Chalybeate springs containing carbonic acid in combination.

Dorton, Buckinghamshire, England.

Contains sulphate of iron and is charged with carbonic acid. Requires dilution for drinking.

Hastings, Sussex, England.

Contains sulphates of iron, magnesia, lime, and soda.

Sandrock, Isle of Wight.

Is a strong aluminous chalybeate: 41½ grains of sulphate of iron, and 31½ grains of sulphate of alumina in 20 ounces, and therefore requires dilution for drinking.

Tunbridge, Kent, England. Altitude, 289′; temperature, 50° Fahr.

This water contains ⅛th of a grain of iron with carbonic acid, in 20 ounces.

Spa, Belgium. Altitude, 1030′. Season, August and September. Temperature of water, 52° Fahr.

These waters contain carbonates of iron, manganese, soda, lime, and magnesia, etc., and are highly charged with carbonic acid.

Pyrmont, Waldeck. Altitude, 404′; mean annual temperature, 48.5° Fahr.

The quantity of carbonic-acid gas is unusually great in these waters. They contain sulphates of lime, soda, magnesia, and carbonates of iron, soda, magnesia, and lime.

Alexisbad, near Harzgerode, Germany.

Alexisbrunnen. Same.

Both contain iron and manganese in large quantity, and also carbonic-acid gas. The first named, being highly impregnated with chloride and sulphate of iron, is used for bathing, and the other for drinking.

Schwalbach, Nassau. Altitude, 909′. Season, June to September. Temperature, 64° Fahr.

According to the analysis of Fresenius, this valuable water contains bicarbonates of iron, manganese, soda, magnesia, and lime, sulphates of soda and potash, and chloride of sodium. It is very highly charged with carbonic acid.

St. Moritz, Upper Engadin, Switzerland. Altitude, 5464′. Mean temperature of summer months, 51° Fahr.

These springs contain from 10 to 14 grains of solids in a pint, consisting of carbonates of lime, magnesia, manganese, iron, and soda, etc., and as much as 39.5 cubic inches of carbonic acid.

THERAPY OF CHALYBEATE WATERS.—The uses of these waters are the same as the purely medicinal preparations of iron. They are indicated in *chlorosis* and *anæmia*, to supply to the blood the material in which it is deficient. For this purpose the milder waters, containing carbonate of iron and abundant carbonic acid, are most suitable; for example, in this country, Rawley Springs, Sweet Chalybeate, Bedford (Pennsylvania); in England, Bascombe and Tunbridge; on the Continent, Pyrmont, Spa, Schwalbach, St. Moritz. When *passive hæmorrhages*—the *hæmorrhagic diathesis*—require ferruginous waters, the alum and iron waters are more effective. *Amenorrhœa*, *hysteria*, and other *pelvic disorders*, when dependent on anæmia, the *paludal cachexia*, *leucocythemic-exophthalmic goitre*, are either cured, or decidedly ameliorated by chalybeate waters.

The purgative iron waters are useful in *engorgement of the liver*, *hæmorrhoids*, and *dyspepsia of anæmic subjects*, in *albuminuria* and *dropsy*. The alum springs in *chronic diarrhœa* and *strumous diseases*.

Neuralgia, *chorea*, *cerebral anæmia*, and other *nervous disorders due to an impoverished condition of the blood*, are much improved by the use of the milder chalybeate waters.

In making selection of a chalybeate water, the psychical influences of mountain scenery, or other pleasant surroundings, should not be disregarded. For the anæmic pulmonary invalid, elevation of the spring and the absence of humidity are important considerations to determine a selection. Hence, the present popularity of St. Moritz. In this country a great variety is afforded—mountain scenery like Bedford, Pennsylvania, and the Virginia springs, or rolling upland like Bailey's and Sharon. As respects composition, the ferruginous springs of the United States are equal to any in the world.

Authorities referred to (*see articles on Alkaline and Saline Springs*).

None of the remedies heretofore considered, contained in the group of agents promoting constructive metamorphosis, are foreign to the organism. They are all necessary to and directly promote the formation of the blood and tissues.

In the same group, however, are remedies which, while they are tonic and reconstituent, do not enter into the composition of the body. They promote, in an indirect way, the constructive metamorphosis. Among these are bismuth, arsenic, the simple bitters, cinchona and its alkaloids. These agents having performed their office are, after a variable period, eliminated from the organism. Their therapeutical effects cannot be entirely comprehended in the process of constructive metamorphosis, and in the ultimate results of their physiological actions the destructive metamorphosis may be included

BISMUTHUM.

Bismuth.—*Bismuthi subcarbonas, subcarbonate of bismuth.* A white or yellowish-white powder, without taste or smell, insoluble in water. Dose, gr. x—ʒ j, in powder or emulsion.

Bismuthi Subnitras.—Subnitrate of bismuth. A heavy, white powder, with a faintly acid odor and taste, insoluble in water. Dose, gr. x—ʒ j, in powder or emulsion.

Besides these officinal preparations, various compounds of bismuth are prescribed. None of these present any advantages over the officinal forms, and most of them are objectionable from various considerations. The solutions of bismuth do not produce the effects of the insoluble subcarbonate and subnitrate, and the various trade preparations containing bismuth and pepsin, bismuth and strychnia, bismuth and calisaya, etc., are, to the last degree, unscientific and unreliable.

Physiological Actions.—The insoluble preparations have a very slightly-metallic taste. They coat the tongue black by the formation of a sulphide. Given in suitable cases, they promote the appetite and increase the digestive power, and a gain in body-weight is one result of their administration. They are somewhat astringent, and retard the intestinal movements. As they are nearly insoluble, they pass down the intestinal tract and are converted into sulphides; hence the fæces under their use become a dark-slate color. They are not entirely insoluble, for bismuth can be detected in the blood, uripe, and other secretions, after a course of these medicines. Sufficient is absorbed under some circumstances, it is said, especially after prolonged administration, to cause toxic symptoms; but such a result must be due to accidental combinations, or to the presence of arsenic, which is a very constant impurity in the ordinary commercial preparations of subnitrate and subcarbonate of bismuth. Trousseau and Pidoux remark, with regard to its presumed toxic effects, as follows: "When the subnitrate of bismuth has been prepared from the perfectly pure metal, precipitated and well washed, it may be given in single doses from one to four grammes (fifteen grains to a drachm) without producing the least *malaise.*" According to the same authority, Dr. Monneret has often given as much as ten to sixty grammes a day, without any recognized ill effects. It may, therefore, be concluded that the action of bismuth is chiefly local.

Therapy.—In the *aphthæ* of children, *nursing sore-mouth*, the milder cases of *mercurial salivation*, and in those painful ulcers of the mucous membrane of the mouth due to disorders of digestion, bismuth applied freely to the affected parts is often very serviceable, by diminishing the pain and promoting the healing process. Bismuth allays the irritability of the mucous membrane in cases of *acute indigestion*, if given after the contents of the stomach are fully evacuated. It is especially indicated when there is not only *painful digestion*, but a *tendency to diarrhœa*, the inclination for stool coming on soon after the food has been taken. It is given with great advantage in *subacute and chronic gastritis*, and in *gastralgia* arising from a state of irritation of the gastric mucous membrane. It is contraindicated, and is not beneficial, in the gastralgia produced by habitual constipation and in the gastralgia of chlorosis and hypochondria. The pain and vomiting attendant on *gastric ulcer* and *scirrhus of the stomach* are relieved by bismuth, and in the case of the former disease this remedy contributes to the cure. In these painful affections, the good effects of the bismuth are enhanced by combination with morphia. ℞. Bismuthi subnitrat., ʒ ij; morphia suhlpat. gr. j. M. ft. pulv. no. vj. Sig. One three times a day in milk. When morphia is, from any cause, inadmissible, hydrocyanic acid may be given in a mixture with bismuth. ℞. Bismuthi subnitrat., ʒ ij; acid. hydrocyan. dil., ʒ ss; mucilag. acaciæ, aquæ menthæ pip., āā ℥ ij. M. Sig. A tablespoonful three times a day. Although arsenic as an impurity is so objectionable that special pains are taken in the pharmaceutical process to separate it in the preparation of subnitrate, yet the author has witnessed excellent results from a combination of arsenic and bismuth in the more chronic stomach-disorders for which the latter is prescribed.

When bismuth is not well borne by the stomach, it may be combined with aromatic powder, or, when alkalies are indicated, it may be given with chalk or magnesia. When constipation is produced by it, bismuth can be administered with rhubarb or magnesia.

Bismuth is one of the remedies most frequently employed in the treatment of the *vomiting of teething children*, *cholera infantum*, *and summer diarrhœa*. Numerous combinations are employed: with pepsin, when these disorders appear to depend on the condition known as *apepsia*, the discharges containing masses of undigested caseine; with rhubarb, when the symptoms are produced by undigested aliment, or when the stools are white and pasty; with soda and chalk, when the stools are acid and excoriate the buttocks. In cases of *vomiting* of *pregnancy*, the *vomiting* of *teething children*, *acidity*, and *pyrosis*, excellent results are sometimes obtained from bismuth and carbolic acid. ℞. Bismuthi subnitrat., ʒ iij; acid. carbol., gr. ij—gr. iv; mucil. acaciæ, ℥ j; aquæ menthæ pip., ℥ iij. M. Sig. A tablespoonful for adults and a proportionate quantity for children three or four times a day.

The *diarrhœa of typhoid fever* is restrained by bismuth in scruple to half-drachm doses. In *chronic diarrhœa* large doses of bismuth are beneficial and often curative, but thirty to sixty grains must be given every three or four hours. Equally large doses check the *diarrhœa of phthisis*. In these doses bismuth not only restrains the intestinal discharges, but improves the appetite and the digestion.

Bismuth is employed for a variety of purposes in the treatment of *external maladies.* It is a good application to the reddened surface of the skin in cases of *acne rosacea*, and may be used as a cosmetic in this mortifying disease. The author has seen excellent results from the free application of bismuth in cases of *eczema* when there was much serous exudation. Under the crusts thus formed healing proceeded satisfactorily. In *intertrigo* and in the *erythema* which occurs about the genitals of infants, dusting the affected surface with bismuth soothes the pain and promotes healing. Bismuth is one of the numerous applications to the eye in cases of *chronic conjunctivitis* and *granular lids.* It is also used as an injection, mixed with mucilage or with cocoa-butter in the form of a suppository, in *chronic gonorrhœa* and in *gleet*, and in *leucorrhœa.* ℞. Bismuthi subnitrat., gr. vj; hydrarg. chlor. cor., gr. ss.; tinct. camphoræ, m. jss; aquæ ad ℥ j. M. Lotion for skin-diseases.

The best vehicle for the administration of bismuth is milk. It should be given before meals as a rule when employed in stomach-disorders.

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ARSENICUM.

Arsenic.—*Acidum arseniosum; arsenious acid; acide arsénieux*, Fr.; *Arsenige saüre*, Ger. Dose, $\frac{1}{30}$—$\frac{1}{10}$ grain.

Arsenici Iodidum.—Iodide of arsenic. Is an orange-red, crystalline solid, entirely soluble in water, and wholly volatilized by heat. Dose, gr. $\frac{1}{20}$.

Liquor Arsenici Chloridi.—Solution of chloride of arsenic. Dose, m. ij—v.

Liquor Arsenici et Hydrargyri Idodidi.—Solution of iodide of arsenic and mercury; Donovan's solution. Dose, m. ij—v.

Liquor Potassii Arsenitis.—Solution of arsenite of potassium; Fowler's solution. (Arsenious acid, bicarbonate of potassium, compound spirit of lavender and distilled water.) Dose, m. ij—x.

Liquor Sodii Arseniatis.—Solution of arseniate of sodium; Pearson's solution. Dose, m. ij—xx.

Arsenic in solution is better for internal administration than the solid arsenious acid, and, of the three solutions (officinal) mentioned above, Fowler's is the best. Arsenious acid when administered in the solid form and at short intervals may act with unexpected violence.

When a course of arsenic is begun, large doses should be prescribed, and the quantity administered should be regularly reduced. In this way chronic arsenical poisoning is avoided. When continually increasing doses are given, the arsenic accumulates, and toxic symptoms are quickly induced. As a rule, unless very small doses are prescribed, arsenic should be taken after meals. Some subjects are soon seriously affected by even small doses of arsenic. For this reason, when the idiosyncrasies of the patient are unknown, it were better to make tentative experiments with a few small doses before beginning with large ones. A few drops of laudanum given with arsenic will enable it to be better borne by some susceptible subjects.

ANTAGONISTS AND INCOMPATIBLES.—The salts of iron, magnesia, and lime, and astringents, are chemically incompatible. The arseniate of iron, although not actively so, does cause toxic symptoms if continued in full medicinal doses. The hydrated sesquioxide of iron, *freshly precipitated*, and in a soft magma, is the antidote to *arsenic in solution*. About eight grains of the antidote are required for each grain of the poison swallowed. As the hydrated sesquioxide of iron is harmless, it should be given in teaspoonful to tablespoonful doses, every few minutes. In every case of poisoning by arsenic, prompt efforts to secure evacuation of the contents of the stomach are necessary. Large doses of the antidote may be given with the emetic employed. In the absence of the hydrated sesquioxide of iron, magnesia, chalk, and lime-water may be given freely. These agents act in part, and probably chiefly, mechanically, by enveloping the particles of arsenic, and so hindering absorption. It is held by some that freshly precipitated hydrate of magnesia is more effective as an antidote than the hydrated sesquioxide of iron. Large draughts of oil, milk, and substances containing mucilage, by protecting the mucous membrane, render important service in cases of arsenical poisoning. The gastro-enteritis and the nervous symptoms produced by arsenic should be treated on general principles. It is an important point to favor rapid elimination of the poison when the patient survives the acute symptoms. This is accomplished by the use of diluent drinks, skimmed-milk, slightly alkaline mineral waters, etc.

SYNERGISTS.—All those agents which promote constructive metamorphosis are synergistic to arsenic.

PHYSIOLOGICAL ACTIONS.—Applied to the tissues, arsenic excites violent inflammation and causes destruction of the part; it is, therefore, an escharotic. Great pain attends its action. In consequence of the high degree of inflammation which it excites, when applied in sufficient strength, absorption does not follow its local use, but weak applications may excite dangerous symptoms by diffusion into the blood.

Symptoms of poisoning follow the inhalation of arsenical fumes. Numerous instances have occurred in which wall-papers colored with arsenical pigments have poisoned the occupants of an apartment. Garments colored with aniline dyes, fixed by arsenical mordants, have induced local ulcerations and systemic symptoms from absorption of arsenic. Applications to a large portion of even the unbroken integument, and to ulcerated surfaces, have, in numerous instances, excited dangerous symptoms, and have produced fatal results. That arsenic, wherever applied, manifests a selective action on the mucous membrane of the respiratory and digestive tracts, is a curious fact.

Arsenic, in small medicinal doses, promotes the appetite and digestive functions, and improves the body nutrition. It increases secretion of the gastro-intestinal mucous membrane, and hastens the peristaltic movements. Arsenic diffuses into the blood with facility. It probably enters into combination with the red-blood globules. It certainly lessens the excretion of carbonic acid, probably also of urea; in other words, it checks the retrograde metamorphosis. It stimulates the cerebral functions and induces a feeling of well-being, and in some subjects decided mental exhilaration.

In larger doses, yet not in quantity to produce acute poisoning, and when full medicinal doses have been administered for a lengthened period, arsenic causes more characteristic physiological actions than are described above. As regards the digestive organs, the following phenomena occur: A metallic taste; increased flow of saliva; nausea, vomiting of glairy mucus, epigastric pain, and soreness; diarrhœa, tenesmus, and sometimes dysenteric stools. As regards the circulatory and respiratory organs: the action of the heart becomes irritable and feeble, palpitations, cough, oppressed breathing, œdema of the eyelids, general œdema, and albuminuria occur. As regards the skin: itching of the eyelids, urticaria, eczema, pityriasis, psoriasis, and falling out of the nails and hair. As regards the nervous system: disorders of motility—trembling, stiffness, and contraction of the joints, disorders of sensibility, herpes zoster.

Notwithstanding the effects above described are so frequently observed to follow the use of arsenic, it is undoubtedly true that a certain degree of *tolerance* may be established when doses in themselves toxic can be taken with impunity. This state has been produced in the course of the legitimate administration of arsenic, and has been witnessed on a considerable scale among the arsenic-eaters of Styria and Southern Austria. The arsenicophagi begin the habit of arsenic-eating at an early age, and become habituated to the use of enormous doses. They find that this practice is serviceable in several respects: they improve in bodily condition, gain in breathing-power, and become stronger and more pugnacious, and also more salacious.

When arsenic is swallowed in sufficient quantity to cause the symptoms of acute poisoning, the phenomena produced are of two kinds—gastro-intestinal irritation and cerebral effects. The former is much the more common. The following are the symptoms of the gastro-intestinal form of acute arsenical poisoning: Burning at the epigastrium, and radiating thence over the abdomen; violent and uncontrollable vomiting; great dryness of the mouth and fauces; intense thirst; intestinal irritation, bloody and offensive stools, retracted abdomen; strangury, priapism, suppression of urine or bloody urine, and in females menorrhagia; rapid and feeble action of the heart, oppressed breathing; great agitation and restlessness; shrunken features, cold breath; involuntary evacuations; collapse—consciousness being retained to the last. In the cerebral form of acute poisoning, without any symptoms of gastro-intestinal irritation, the patient is suddenly put into a condition of profound insensibility and coma, not unlike extreme opium narcosis.

Recovery from the effects of acute arsenical poisoning is rarely complete. For a long time afterward a considerable degree of gastro-enteric irritability will persist, and life may at last be lost from the continued operation of this pathological state on the function of nutrition. An irritable state of the skin and stiffness of the joints may also continue for some time, and paralysis may supervene, accompanied with neuralgic pains, numbness, formication, etc.

The changes found after death in the gastro-intestinal mucous membrane are those due to an irritant: deep redness, erosions, ecchymoses, and softening. These symptoms are also produced when toxic effects are caused by the external application of arsenic. More or less redness of the tracheal and bronchial mucous membrane and congestion of the lungs have been observed. It must not be forgotten that arsenic has caused a fatal result without producing any gastro-intestinal lesions except some uncharacteristic redness. Fatty degeneration of the liver, kidneys, spleen, and other organs, has been observed in cases of acute poisoning, even when the symptoms have existed for a few hours. The icterode hue of the skin and the albuminuria which occur in the course of chronic arsenical poisoning are probably due to fatty degeneration of the liver-cells and of the renal epithelium.

Arsenic, although like other mineral poisons it tends to accumulate in the system, is nevertheless eliminated with considerable rapidity. If the patient survive a week after the ingestion of a toxic dose, it is difficult to detect it in the body after death. If the poison is retained, and death ensues before elimination can take place, it undoubtedly retards putrefaction. Arsenic is eliminated by various organs—by the liver, intestinal canal, kidneys, and bronchial tubes—and some of the symptoms produced by it probably have their origin in the local effect of the poison on the channels of excretion.

The quantity of arsenic required to produce a fatal effect varies according to the state of the stomach and the susceptibilities of the patient. Ounces have been swallowed without producing even serious symptoms, because promptly rejected by vomiting. When the stomach is full of food, absorption is slow and vomiting is easily induced, and hence a toxic dose may not under these circumstances produce any of the phenomena of poisoning. A half-grain of arsenious acid has caused symptoms of poisoning (Taylor), and, according to the same authority, from two to four grains may prove fatal to an adult. Much depends on the idiosyncrasies of the individual, which, as has been stated above, differ greatly in different persons. These facts should not be forgotten in prescribing strictly medicinal doses of arsenical preparations.

THERAPY.—The preparations of arsenic are applicable to the treatment of the diseases of those tissues upon which it has a selective action.

No remedy is more useful than arsenic in the so-called *irritative dyspepsia*, manifested by these symptoms : a red and pointed tongue, poor appetite, distress after meals, the presence of the food causing intestinal pain, colic, and the desire to go to stool. Drop-doses of Fowler's solution, given before meals, quickly relieve this state of things. The effects of the arsenic are frequently favored by the conjoint administration of a little laudanum.

In some cases of the *vomiting of pregnancy*, a drop of Fowler's solution given before each meal will afford astonishing relief. The particular indications for its use are these: vomiting of food, followed by retching and straining, the vomited matters being streaked with blood, or blood alone being thrown up; these symptoms accompanied by gastralgia and pain between the scapulæ.

The vomiting of *chronic gastric catarrh*, especially the alcoholic form, is relieved by one or two drops of Fowler's solution taken before meals. It effects a cure in these cases by relieving the morbid state of the mucous membrane on which the vomiting depends. Arsenic is also very beneficial in these small doses in *chronic ulcer of the stomach*. It checks the vomiting, relieves the pain, and improves the appetite for food. It is not equally effective in the *acute ulcer*. Although arsenic exercises but little influence over the progress of these cases, it is very serviceable in *cancer of the stomach*, by diminishing the pain and checking the vomiting. *Gastralgia* and *enteralgia*, when idiopathic, are sometimes made to disappear in a very surprising manner by the same remedy, but there are no certain indications of the kind of case to which it is best adapted.

In the treatment of stomach-disorders, only small doses of arsenic are admissible. Large doses, by creating an irritation of the gastric mucous membrane, will only defeat the end in view.

That form of *diarrhœa* which consists merely in an intolerance of the presence of food, an evacuation of the undigested aliment taking place soon after it is swallowed, is cured by arsenic. *Chronic diarrhœa* and *dysentery* (entero-colitis), especially when dependent on the changes induced by chronic malarial infection, are often greatly benefited by the same remedy. In these cases, two drops of Fowler's solution with five drops of laudanum should be given before meals. Attention to the diet is, of course, imperative. *Constipation,* when due to deficient secretion and dryness of the fæces, is sometimes overcome by small doses of Fowler's solution.

Arsenic is one of the numerous remedies proposed for the treatment of *epidemic cholera.* It is a curious circumstance, first demonstrated by Virchow, that some cases of acute arsenical poisoning are not distinguishable by their symptomatology or morbid anatomy from cases of epidemic cholera.

Arsenic has been used with success in the treatment of the *jaundice* due to catarrh of the bile-ducts succeeding to catarrh of the duodenum. It seems to the author to be better adapted to cases of *jaundice* of *malarial* origin. Excellent results are obtained by the persevering use in small doses of arsenic in *cirrhosis.* As arsenic tends to accumulate in the liver, and as it produces fatty degeneration of this organ, the curative effect in the above-named disorders may depend on this selective action.

There is no doubt that arsenic promotes in a very decided manner the constructive metamorphosis. It is one of the most valuable agents which we possess in the treatment of *chlorosis* and *anœmia.* It is especially adapted to those cases in which iron does not agree or fails of effect. The efficiency of iron in these disorders is much increased by combination with arsenic.

Cases of *acute coryza* and *hay-asthma* are often decidedly relieved by this remedy. *Chronic catarrh of the broncho-pulmonary mucous membrane, emphysema, sclerosis of the lungs,* are maladies in which arsenic, long used in ordinary medicinal doses, is capable of effecting considerable amelioration. We have no single drug of equal utility in the chronic forms of *phthisis,* but it is not serviceable in caseous pneumonia. It is said, and this statement corresponds to the author's observation, that, when there are much hectic and rapid disintegration of the pulmonary tissues, arsenic is not beneficial. Besides the stomach administration of arsenic in the above-mentioned maladies of the respiratory organs, it is used with advantage by the process of fumigation. The following is the formula of Trousseau for arsenical cigarettes:

Arsenite of potassa	15 grains.
Distilled water	1 ounce.

Unsized white paper is thoroughly moistened with this solution, dried and cut into twenty equal parts, and each part rolled into a cigarette. Two or three of these are smoked daily for the relief of *chronic* *bronchitis*, *emphysema*, *spasmodic asthma*, *phthisis*, *hay-asthma*, etc. The arseniate of soda may be used in the same way, and under the same conditions; for example, take a half-drachm to one drachm of arseniate of soda, one ounce of distilled water, and moisten a bit of unsized paper with the solution, so that every piece of a given size shall contain a determined quantity of the arsenic, ordinarily from one-fourth to one grain. When the cigarette is lighted, the patient inhales the smoke by a single inspiration, and this inhalation is practised three or four times a day. In cases of *acute and chronic coryza*, great advantage is obtained by snuffing into the nares the fumes of arsenical cigarettes. The arsenite of antimony, according to Dr. Lucien Papillaud, is especially serviceable in pulmonary affections.

When, in consequence of feebleness of the heart, there are present *short breathing* on making slight exertion, and *œdema of the feet and ankles*, especially as these symptoms occur in old people, arsenic is indicated. Attacks of *angina pectoris* may be lessened or prevented by the persistent use of arsenic in the interval.

Certain disorders of the nervous system are greatly benefited by the use of arsenical preparations. The author has seen it extremely useful in *cerebral congestion*, for the treatment of which it was originally recommended by Dr. Lemare-Picquot. It is indicated when there are commencing ætheroma of the cerebral vessels, sluggish venous circulation, puffiness of the eyes, tendency to drowsiness, and intellectual torpor. In the *melancholy* and *hypochondria* of the aged, it gives great comfort, and frequently entirely dispels the gloomy fancies which take possession of the mind under these circumstances., The arsenic acts most favorably when combined with minute doses of opium; viz., two drops of Fowler's solution, with three to five drops of tincture of opium, given three times a day. Arsenic is one of the remedies successful in the treatment of *neuralgia*. Generally its curative influence is indirect, and exerted through the improvement in the bodily nutrition, which follows its administration. It is directly curative, however, in the cases of *hemicrania* and other *neuralgiæ* of *malarial origin*, but it holds a place strictly secondary to quinia in these affections. It is certainly one of the most effective remedies which we possess in the treatment of *chorea*. In this disease, large doses—five minims *ter in die*—must be given. Young subjects, it should be remembered, bear large doses of arsenic, relatively, better than adults. Cases of *epilepsy* have been reported cured by arsenic, but these were probably instances of *epileptiform vertigo* caused by stomach-disorder, in which this remedy is undoubtedly of great utility. In the *état nerveux* of the French physicians —*hysteria*—arsenic lessens the mobility of the nervous system, and, by improving the general nutrition, permanently removes the nervous erethism.

Arsenic produces, in the course of its medicinal administration, affections of the skin, and notably those dependent on an unknown state of the trophic nerves. In the treatment of various skin-affections we avail ourselves of this physiological fact, and set up by means of arsenical preparations a *substitutive* action in the skin. It follows, that arsenic will not be serviceable in *acute* affections of the skin, and experience demonstrates that, whenever active cell-proliferation is taking place, arsenic is contraindicated. It is most serviceable when the affection of the skin is superficial in its seat—in the epidermis and the superficial layers of the derma. In cases of *psoriasis* much good may be expected from it, but, the more chronic the disease, the more beneficial is it. When the arsenic begins to exert an influence on *psoriasis*, the skin appears more inflamed, but this is an evidence that the curative action is taking place, and the remedy should then be persisted in. *Acute eczema* is rather exasperated by arsenic, but *chronic eczema*, especially *eczema squamosum*, is often greatly benefited by it. When eczema infests the vulva, anal region, and scrotum, arsenic is said to be useful, but its efficacy in these cases is largely determined by the chronicity of the attacks. *Pemphigus* is an affection of the skin, which, as was more particularly shown by Mr. Hutchison, is curable by arsenic, but the more chronic the disease the more certainly beneficial the remedy. In old cases of *acne*, especially *acne rosacea*, arsenic is sometimes serviceable, but it is often very disappointing. The author has not observed much good to follow the use of arsenic in the acne which occurs at puberty and for some years subsequently. In all cases of acne the strictest attention to diet and a proper hygiene is very important. Arsenic given with bromide of potassium lessens or prevents the very disfiguring *acne* which appears in the course of the administration of that agent. *Furuncle* (boils) is successfully treated by the long-continued use of arsenic. This practice is strongly urged by Dr. Delioux de Savignac. A succession of boils is the indication for the use of this remedy.

In the treatment of skin-affections, Fowler's solution is the arsenical preparation most frequently employed. The commencing dose need not be larger than five drops three times a day, given after meals. It is better to commence with the maximum dose, and to diminish the amount gradually. As arsenic needs to be administered for a long time in skin-diseases, such toxic symptoms as irritation of the eyelids, and puffiness of the eyes, and epigastric pain and soreness, are apt to arise. These symptoms are indications for the use of laxatives, and for a reduction in the dose of the remedy, but not for its entire suspension. In order to prevent relapses, the use of arsenic should be continued, in diminishing doses, for some time after the entire disappearance of the eruption.

Arsenic is not serviceable in *skin-diseases* of *syphilitic origin*. In very chronic cases of this kind the compound solution of arsenic, iodine, and mercury—Donovan's solution—is sometimes very effective, but the curative effect is here due to the iodine and mercury, rather than to the arsenic.

Arsenic is very useful in a certain form of *chronic arthritis*. The cases to which it is adapted are those in which the joints become tumid and stiff and painful in consequence of a peculiar state of the nervous system; indeed, the condition is one allied to neuralgia, the trophic nerves being involved. This is a malady very different from that kind of chronic rheumatism or rheumatic gout which is accompanied by nodosities of the joints, in which arsenic has been recommended, but over which, according to the experience of the author, it exerts no control.

Diabetes, occurring in thin subjects from a faulty condition of the primary assimilation, is much benefited by arsenic; but when diabetes makes its appearance in fat subjects after a succession of boils and carbuncles, arsenic is not useful.

Amenorrhœa, when due to functional inactivity of the ovaries, and *menorrhagia*, when produced by anæmia, are equally benefited by the preparations of arsenic, especially when combined with iron. *Spermatorrhœa*, if dependent on a weak and relaxed state of the seminal vesicles, and *functional impotence*, are sometimes greatly improved by full doses of the arseniate of iron. It is often advantageous to combine the arseniate of iron and ergotine, as follows: ℞. Ferri arseniat., gr. v; ergotine (aq. ex.), ʒ ss. M. ft. pil. no. xxx. Sig. One night and morning.

Next to quinia, arsenic has the most important position in the treatment of *malarial fevers*. It may be used to prevent the recurrence of attacks of *ague* when quinine for any reason is not admissible. As regards acute malarial toxæmia, arsenic is more useful as an adjunct to quinia than as the sole remedy. The treatment of acute cases may be formulated as follows: large doses of quinia to interrupt the paroxysms, and at the septenary periods; arsenic given daily to prevent relapses. It plays a more important *rôle* in chronic malarial diseases. As has been shown by Boudin, arsenic diminishes the engorgement of the spleen. The author has witnessed the rapid disappearance of *malarial jaundice*, and the cure of the alterations in the glandular appendages of the intestinal mucous membrane, under its use. It is most useful generally to combine iron with arsenic in the chronic form of malarial disease. ℞. Pil. ferri carbon., ʒ j; acidi arseniosi, gr. j. M. ft. pil. no. xx. Sig. One three times a day. ℞. Quiniæ sulph., ℈ij; ferri sulph. exsic., ℈j; acidi arseniosi, gr. j. M. ft. pil. no. xx. Sig. One three times a day. Boudin justly insists upon abundant alimentation during a course of arsenical treatment of intermittents, and, with a view of preparing the digestive organs, administers a preliminary emetic to relieve the stomach of the *embarras gastrique*. Arsenic has also been used as a *prophylactic* against malarial infection, and as a remedy for various intermittent diseases due to malarial influence. The author has seen excellent results from the use of small doses of Fowler's solution three times a day in *typho-malarial fever*. When there is much diarrhœa, a few drops of tincture of opium should be added to each dose of arsenic. In doses of half a drop to one drop of Fowler's solution, the tongue cleans, the skin becomes moist, and the delirium lessens in a most remarkable manner, sometimes. When arsenic is used alone in the treatment of intermittents, large doses are necessary. Ten drops of Fowler's solution may be given after meals to adults, but in a few days—three, four, or five, according to the susceptibility of the patient—the dose must be reduced two drops each day until four drops are reached. If the stomach does not become disordered, slight irritation of the conjunctivæ and puffiness of the eyelids may be disregarded.

There can be no doubt that the long-continued use of small doses of arsenic exercises a favorable influence over the course and progress of *epithelioma*. It has appeared, indeed, to be useful in *scirrhus*, especially as this morbid process manifests itself in the stomach. *Rodent ulcer*, which is closely allied in its nature to epithelioma, is also improved by it. With the internal use of the arsenical preparations may be conjoined the local applications of arsenious acid. Many physicians, notably Dr. Atlee, of Philadelphia, entertain the belief that the long-continued use of arsenic retards the growth of *uterine cancer*. It appears to the author to be certain that arsenic is useful in epithelioma, but he regards it as improbable that it exerts a curative influence over the other forms of cancer, although it alleviates some of the distress experienced by the subjects of cancer of the stomach. Billroth reports a case of *multiple lymphoma* cured by the use of arsenic.

External Uses of Arsenic.—An arsenical paste having the following composition is used to destroy the sensibility of a carious tooth: arsenious acid, ij; sulphate of morphia, j; sufficient creosote to make a paste. A small quantity of this is applied by a bit of cotton-wool to the carious portion of the tooth.

Arsenious acid is sometimes employed to destroy cancerous growths. But, as it is extremely painful, and as the danger of absorption is great, other escharotics, as, for example, the chloride of zinc, are generally preferred. When it is used, the operator should be careful to employ an arsenical paste of sufficient strength to set up a limiting inflammation, and thus prevent absorption. From one-sixth to one-fifth of arsenious acid is the proper proportion, and it may be mixed with calomel, starch, or other impalpable powder. If the surface to be destroyed is large, a portion of it should be submitted at a time to the action of the escharotic. Poultices should then be applied until the slough separates, when a healthy granulating surface is obtained. The excessive pain caused by the escharotic may be much alleviated by combining morphia and carbolic acid in the arsenical paste, or by the use of morphia hypodermically until the escharotic action ceases.

An arsenical paste prepared as follows is sometimes used as a depilatory: quicklime, ℥ ss; yellow sulphide of arsenic, xx grs.; starch, clxxx grs. A preparation of this kind is such a one, probably, as that used by the Egyptian women to remove the hair from the pubes, but Larrey, who mentions the practice in his Memoirs, expressly abstains from giving the formula, lest it might be abused.

In addition to the above local uses of arsenic, it may be mentioned that Dr. Radcliffe has introduced the hypodermic method of employing it. He has obtained excellent results from the insertion of m. v—m. xv of Fowler's solution into the affected muscles in cases of *local chorea.* The arsenical solution should be diluted with an equal measure of water when thus used.

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THE SIMPLE BITTERS.

Quassia.—*Quassi amer*, Fr.; *Quassienholz*, Ger. The wood of Simaruba excelsa.

Preparations.—*Extractum Quassiæ.* Extract of quassia. Dose, gr. j—gr. iij.

Tinctura Quassiæ.—Tincture of quassia (2 oz. to Oj). Dose, m. v—ʒ j.

Infusum Quassiæ.—Infusion of quassia (ʒ ij to Oj). Dose, ʒ ij —℥ j.

Composition.—Quassia-wood contains a crystallizable bitter principle, neutral, called *quassin*.

Gentiana.—*Gentian*, *gentiane*, Fr.; *Bitterwurzel*, Ger. The root of Gentiana lutea.

Preparations.—*Infusum Gentianæ Compositum.* Compound infusion of gentian. (Gentian, bitter orange-peel, coriander.) Dose,

Gentianæ Composita.—Compound tincture of gentian. (Gentian, bitter orange-peel, cardamom, alcohol.) Dose, ʒ ss—ʒ ij.

Extractum Gentianæ Fluidum.—Fluid extract of gentian. Dose, ʒ ss—ʒ ij.

Extractum Gentianæ.—Extract of gentian. Dose, gr. j—gr. v.

Composition.—Gentian contains a peculiar principle, *gentianine*, and an acid, *gentisic acid*.

Gentiana Catesbæi.—Blue gentian, American gentian. This indigenous remedy may be used as a substitute for the foreign gentian, and similar preparations to the officinal formula for gentian, as above, may be prepared from it.

Unofficinal Formulæ.—Mistura gentianæ alkalina. Dilute hydrocyanic acid, m. iij; bicarbonate of soda, grs. xv; compound infusion of gentian to oz. j.

Mistura Gentianæ et Sennæ.—Infusion of gentian, drachms vj; infusion of senna, drachms iij; compound tincture of cardamoms, drachm j.

Calumba.—*Colombe (racine de)*, Fr.; *Ruhrwurzel*, Ger. The root of Cocculus palmatus.

Preparations.—*Infusum Calumbæ.* Infusion of calumba (℥ j—Oj). Dose, ℥ ss—℥ ij.

Tinctura Calumbæ.—Tincture of calumba (℥ ij—Oj). Dose, ʒ i

Extractum Calumbæ Fluidum.—Fluid extract of calumba. Dose, ʒ ss—ʒ ij.

Composition.—A peculiar principle, *colombin*, *berberina*, and a peculiar acid, *colombic acid.*

Coptis.—*Goldthread.* The root of Coptis trifolia. There are no officinal preparations of coptis. It contains, in common with some other bitters, the alkaloid, *berberina*, and probably also a peculiar bitter principle. It yields up its alkaloids and bitter principle to both water and alcohol, but more freely to the latter. The tincture and fluid extracts are, therefore, the best preparations.

Sabbatia.—*American centaury.* Herb of Sabbatia angularis. As there are no officinal preparations of sabbatia, a tincture and fluid extract made in accordance with the general instructions given in the United States Pharmacopœia may be used.

Cornus Florida.—*Dogwood.* The bark of Cornus Florida.

Preparation.—*Extractum Cornûs Floridæ Fluidum.* Fluid extract of dogwood. Dose, m. x—ʒ j.

Decoctum Cornûs Floridæ.—Decoction of dogwood (℥ j—Oj). Dose, ℥ ss—℥ ij.

Antagonists and Incompatibles.—Quassia and calumba can be administered with the salts of iron. The sulphate of iron, and the silver and lead salts, are incompatible with gentian. The infusion of coptis is not affected by the salts of iron, but is precipitated by the nitrate of silver and acetate of lead. Therapeutically, all those agents which promote waste or destructive metamorphosis are opposed to the action of the simple bitters.

Synergists.—Iron, the mineral acids, pepsin, bismuth, etc., are synergistic to the bitters, and under some circumstances the alkalies promote their therapeutic action.

Physiological Actions.—The simple bitters increase secretion from the mucous membrane. In the mouth they promote the flow of saliva, and in the stomach they appear to increase the production of gastric juice, and also of gastric mucus. It follows that an increase of digestive capacity is one result of their administration. The increased appetite which is observed from the use of the bitters is probably due to two factors: the sense of bitterness which increases the desire for food, and the improved digestive power which, enabling more food to be disposed of, postpones the sense of satiety. Furthermore, the bitters, by removing morbid states of the intestinal mucous membrane, favor assimilation. More food being taken and more thoroughly digested it is obvious that the bitters promote constructive metamorphosis. The blood is indirectly enriched by them, and the tissues are consequently improved in their nutrition. The simple bitters are accordingly usually classed with *tonics*.

Although these remedies, used judiciously and for a short period, undoubtedly promote the constructive metamorphosis, yet their long-continued use will produce gastric catarrh, decrease the flow of healthy gastric juice, and impair digestion.

THERAPY.—An infusion of coptis has much reputation in New England as a remedy in *aphthæ*, *psoriasis of the mucous membrane*, *ulcers*, and *epithelioma*. Used as a gargle, it is serviceable in ulceration of the tonsils.

A few drops of the tincture of calumba, or a teaspoonful of the infusion, will sometimes greatly relieve the *vomiting of pregnancy*, and is also occasionally efficacious in *sea-sickness*. The simple bitters are especially indicated in *atonic dyspepsia*, and in *chronic gastric catarrh*. They are useful in this state of things: pain after food, slow digestion, constipation alternating with diarrhœa. Calumba is the mildest, and may be borne when quassia and gentian disagree. According to Wilson Fox, "calumba holds the chief place in point of therapeutic value as a remedy which can be safely employed when others of the class would be too irritating." When there are much relaxation and torpor, quassia is very useful as a stomachic tonic. Sometimes an extemporaneous cold infusion of quassia is used, made by filling overnight with cold water a quassia-cup—a goblet turned out of quassia-wood. When constipation exists in cases of atonic dyspepsia, good results are obtained by a combination of gentian with senna, as in the formula already given. The compound tincture of gentian is an excellent vehicle for the *administration of cod-liver oil*, and contributes to its digestion and assimilation.

The infusions of gentian, calumba, and quassia, are usefully employed as vehicles for the administration of acids and alkalies in cases of acidity and deficient supply of gastric juice, under the rules given in the articles on acids and alkalies.

In *convalescence from acute diseases*, the simple bitters, especially gentian and calumba, are employed to promote the appetite and digestion, and thus to aid in the process of constructive metamorphosis.

In the *diarrhœa* which is due to relaxation of the mucous membrane, and is not dependent on inflammation, the tincture of calumba is often useful. The author has obtained good results from the use of tincture of calumba combined with opium in the treatment of an irritable state of the intestinal mucous membrane, indicated by these symptoms: Soon after taking food, the occurrence of pain referable to the small intestines, nausea, loose evacuations containing undigested aliments, and followed by weakness and depression. ℞. Tinct. calumbæ, ʒxv ; tinct. opii deodor., ʒj. M. Sig. A teaspoonful in a wineglassful of water before meals. Calumba is also serviceable in the relaxation of the bowels, succeeding to acute affections of the intestinal mucous membrane.

The infusion of quassia is one of the most effective injections for the destruction of the *ascarides vermiculares* which infest the rectum. The stomach administration of simple bitters undoubtedly hinders the development of intestinal worms, probably by correcting a morbid state of the mucous membrane. In the treatment of intestinal parasites much good, therefore, is derived from the use of bitters, administered with the view of restoring normal digestion.

According to Wood, the remedy most effective to remove and "permanently cure a disposition to the *accumulation of flatus in the bowels* is an infusion made with half an ounce of calumba, half an ounce of ginger, a drachm of senna, and a pint of boiling water, and given in the dose of a wineglassful three times a day."

The bitters are used as remedies in *malarial fever.* Although they exercise but little influence over the course of intermittent and remittent fever, they are useful in the form of infusion as vehicles for the administration of more active drugs. In the convalescence from malarial fever, and in *chronic malarial poisoning*, they are more actively beneficial as agents promoting constructive metamorphosis. The dogwood, of all the bitters given in the above list, possesses the most positive antiperiodic qualities, and is considered by the physicians of Southern United States as next to quinia in efficiency. An excellent tonic combination of decided utility in chronic malarial disease is the following: Dogwood-bark, calumba, poplar (liriodendron), wild-cherry, of each six ounces; boneset (eupatorium) and cayenne pepper, of each four ounces. Mixed and sifted. Of the mixture a teaspoonful in cold or warm water, three or four times a day. A useful tincture to serve the purpose of a tonic, and as a remedy in malarial affections, may be prepared from the above combination of bitter tonics.

AROMATIC BITTERS.

Serpentaria.—*Virginia snakeroot. Serpentaire de Virginie*, Fr.; *Schlangenkraut*, Ger. The root of Aristolochia serpentaria, and of other species of Aristolochia.

PREPARATIONS.—*Infusum Serpentariæ.*—Infusion of serpentaria (℥ss—Oj). Dose, ℥ss—℥j.

Tinctura Serpentariæ.—Tincture of serpentaria (℥iv—Oij). Dose, ʒss—ʒij.

Extractum Serpentariæ Fluidum.—Fluid extract of serpentaria. Dose, ʒss—ʒij.

COMPOSITION.—A volatile oil, resin, a bitter principle, etc.

Prunus Virginiana.—*Wild cherry.* The bark of Cerasus serotina.

PREPARATIONS.—*Infusum Pruni Virginianæ.*—Infusion of wild-cherry (℥ ss—Oj). Dose, ℥ ss—℥ ij.

Extractum Pruni Virginianæ Fluidum.—Fluid extract of wild-cherry bark. Dose, ʒ ss—ʒ j.

Syrupus Pruni Virginianæ.—Sirup of wild-cherry. Dose, ʒ j—ʒ ij.

COMPOSITION.—Amygdaline and emulsine, which produce by their reaction hydrocyanic acid, tannic and gallic acids, etc.

Cascarilla.—*Cascarilla. Cascarille*, Fr.; *Cascarille Rinde*, Ger. The bark of Croton eleuteria.

PREPARATIONS.—*Infusum Cascarillæ.* Infusion of cascarilla (℥ j—Oj). Dose, ℥ ss—℥ j.

COMPOSITION.—A crystallizable principle, *cascarillin*, tannic acid, a volatile oil, etc.

Actions and Uses.—These remedies possess the quality called tonic; they invigorate digestion, and promote constructive metamorphosis. They differ from the simple bitters in containing aromatic constituents, and in being astringent to a greater or less degree, owing to the presence of tannic and gallic acids. They are indicated in the same kind of cases as, and under similar conditions to, the simple bitters; but they are supposed to have, in addition, some specific properties derived from their volatile and odorous constituents.

Serpentaria is occasionally used as a stimulating tonic in *typhoid* and *typho-malarial fevers.* It is more frequently prescribed as a stimulant expectorant in *capillary bronchitis*, and in *pneumonia* of low grade, when carbonate of ammonia is combined with it. Formerly it was used locally to the throat, as a gargle in *diphtheria*, and given internally as a stimulant, but it is now very rarely employed in such cases.

Wild-cherry is an excellent *stomachic tonic*, and may well be used as a substitute for calumba in the class of cases to which the latter is considered specially applicable. It has long been held in great esteem in domestic practice, as a remedy in *catarrhal states of the bronchial mucous membrane*, and in *phthisis.* Owing to the prussic acid which its cold infusion contains—produced by the reaction between the amygdaline and emulsine—it exercises some influence over cough. That it has any special virtues in the treatment of phthisis is hardly to be credited The sirup is much used as an ingredient in cough-mixtures.

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Eucalyptus.—Leaves of Eucalyptus globulus.

PREPARATIONS.—*Tinctura Eucalypti.* Tincture of eucalyptus. Dose, ʒ ss—ʒ ij.

Extractum Eucalypti.—Extract of eucalyptus. Dose, gr. j—℈j.

Eucalyptol.—Dose, m. v—ʒ ss. Usually prescribed in capsules, but may be given in the form of emulsion.

COMPOSITION.—Eucalyptus contains an essential oil—*eucalyptol*—a camphor, isomeric with the oil of turpentine, a peculiar resin, tannic acid, chlorophyl, etc. The physiological actions of eucalyptus are due chiefly to the eucalyptol.

ANTAGONISTS AND INCOMPATIBLES.—Alkalies, the mineral acids, the salts of iron, mercury, lead, zinc, etc., are chemically incompatible. All agents promoting waste, or the retrograde metamorphosis of tissue, are therapeutically incompatible.

SYNERGISTS.—The simple and aromatic bitters, hydrastis, cinchona, etc., camphor, turpentine, cubebs, copaiba, the essential oils and substances containing them, are synergistic to or promote the therapeutical actions of eucalyptus. Any of these remedies may, therefore, be prescribed in the same formula with eucalyptus.

PHYSIOLOGICAL ACTIONS.—Eucalyptus has a warm, aromatic, bitter, and camphoraceous taste, resembling somewhat the taste of cubebs. In the mouth it excites the flow of saliva, and leaves a hot, pungent, and rather disagreeable flavor. In the stomach it causes a sensation of warmth, and doubtless promotes the flow of gastric juice. The appetite and digestive power are increased under its use. Increased intestinal secretion, also, is one result of its administration, and hence the alvine evacuations are rendered somewhat more copious and easy. In very large doses it causes a sense of weight and uneasiness at the epigastrium, odorous eructations and indigestion, followed by diarrhœa, the stools having the characteristic odor of *eucalyptol.* The essential oil is readily diffusible and enters the blood with facility, but what changes, if any, it induces in the blood are unknown. It increases the action of the heart, lowers the arterial tension, and induces a feverish state. The respiratory movements are accelerated. Wakefulness is caused by it in those of full health, and sleep in the weak and anæmic. The eucalyptol is eliminated by the skin, mucous membrane of the bronchial tubes, and by the kidneys, the secretions of these organs being increased by it, and they are impregnated with its odor. This is especially the case with the urine, which after some days' administration becomes most strongly odorous by the presence of eucalyptol.

The vapor of eucalyptus, inhaled in large quantity, produces analogous effects to the internal administration, besides the more decided effects on the bronchial mucous membrane.

Eucalyptus is a powerful diaphoretic.

THERAPY.—The decoction of the leaves is an efficient local applica tion in the various forms of *stomatitis*, *angina* subacute and chronic, and *tonsillitis* after the subsidence of the acute stage.

Eucalyptus is one of the most useful of the so-called stomachics in *atonic dyspepsia*, *chronic gastric catarrh*, and *chronic intestinal catarrh*, but its use is contraindicated in inflammatory states. The form of vomiting and indigestion, dependent on the presence of *sarcina*, is relieved by this agent, which acts by destroying the vitality of this minute organism. That condition of the mucous membrane which favors the production of *intestinal parasites* is removed by eucalyptus. In the case of *ascarides vermiculares*, the remedy should be used by injection.

Like the bitters, eucalyptus may be used to promote constructive metamorphosis, but it possesses more decided stimulant effects than these agents, by virtue of the eucalyptol. In *convalescence from acute disease*, in *debility* arising from defective assimilation, and in *cachectic states* generally, it is a serviceable tonic and stimulant. When the action of the heart is weak, it may be strengthened by eucalyptus. To women at the change of life who suffer from *flatulence*, *palpitation of the heart*, and *sudden flushings of the face*, it affords great relief, and often permanently removes these symptoms.

Hysteria, *chorea*, *asthma*, and allied nervous states, when occurring in debilitated subjects, and *cerebral anæmia*, are benefited by eucalyptus. In asthma eucalyptus may be smoked in cigarettes with stramonium, belladonna, tobacco, etc. Its efficacy in the form of fumes is strongly stated by Maclean.

The most important uses of this agent occur in the treatment of *catarrhal affections of the broncho-pulmonary mucous membrane*. It is not adapted to acute affections or to recent inflammation, but to chronic cases accompanied by free muco-purulent expectoration. The author is able to confirm the observations of Gubler in reference to the great utility of eucalyptus in *bronchorrhœa*. It is an interesting fact, and probably explanatory of its therapeutical action, that eucalyptol is in part eliminated by the bronchial mucous membranes. In the same way eucalyptus is effective in the treatment of *catarrhal states of the genito-urinary organs*. *Chronic desquamative nephritis*, *granular degeneration of the kidneys*, *pyelonephritis*, and *hydronephrosis*, are improved by its cautious administration, but it should not be forgotten that, used too freely, or for too great a length of time, it will cause irritation and congestion of the kidneys, in the same way that turpentine, copaiba, and cubebs do.

No remedy which the author has hitherto used has seemed to him so effective in *chronic catarrh of the bladder* as eucalyptus. The urine during its administration acquires a strong odor of eucalyptol, and to its local action on the mucous membrane is to be attributed the therapeutical effect.

Eucalyptus has been much praised as a remedy for *intermittent fever*. The evidence as to its utility is contradictory. As the result of his own observations, and after careful examination of the facts reported by others, the author concludes that eucalyptus is far inferior to quinine. It is certainly very serviceable in the *convalescence from intermittent and remittent fevers*, and in *chronic malarial poisoning* it has a high degree of utility. It cannot take the place of quinine for the arrest of the paroxysms, or to prevent relapses at the septenary periods, but it is more useful than quinine to reconstruct the damages in the organs of assimilation caused by malarial infection.

Externally, the tincture and the distilled water of eucalyptus are used as disinfectant applications to *foul-smelling and ill-conditioned ulcers and wounds* (Gimbert). The water of eucalyptus is recommended by Gubler, as a vehicle for agents used by the hypodermic method. The toxic influence of eucalyptus on the lower forms of life—cryptogamic and infusorial organisms—is the ground of its application for these purposes. As respects solutions of alkaloids for hypodermic use, the water of eucalyptus prevents the development of the *penicillium*, which grows rapidly and at the expense of the alkaloid in solutions prepared with simple distilled water.

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Hydrastis.—*The Root of Hydrastis Canadensis.* Yellow root.

PREPARATIONS.—*Extractum Hydrastis Fluidum.* Fluid extract of hydrastis. Dose, m. v—ʒ ss.

Tinctura Hydrastis.—(Unofficinal.) Dose, m. x—ʒ j.

COMPOSITION.—Hydrastis contains a peculiar principle, *hydrastin* or *hydrastia*, which crystallizes in four-sided prisms, white or colorless when pure, and having but little taste. Hydrastin, the alkaloid, should not be confounded with the eclectic preparation, hydrastin, which is composed chiefly of berberine. Much of the peculiar virtues of hydrastis is probably due to the alkaloid *berberine*, which is contained in it in the proportion of about four per centum. Both of these alkaloids unite with acids to form salts.

ANTAGONISTS AND INCOMPATIBLES.—The alkalies, tannic and muriatic acids, are chemically incompatible with the preparations of hydrastis. Muriatic acid precipitates *berberine*, and the so-called hydrastin of the eclectic practitioners is nothing more than berberine muriate. In prescribing the tincture and fluid extract of hydrastis with other bitters, only those free from tannin should be combined in the same prescription.

SYNERGISTS.—The vegetable tonics in general are synergistic to hydrastis, especially *berberis vulgaris* and *calumba*, both of which contain berberine.

PHYSIOLOGICAL ACTIONS.—The preparations of hydrastis have a decidedly bitter taste, and, like other bitters, promote the flow of saliva, and probably, also, of gastric juice. Increased appetite and digestive power result from its administration. It is, therefore, a *stomachic tonic.* It also increases secretion of the intestinal mucous membrane—its glandular appendages—and, there are good reasons for believing, promotes the flow of bile. As a result of this increase of secretion, the stools become softer and more frequent under its use, and it has hence been styled a laxative. The bodily condition, or constructive metamorphosis, is promoted by its administration. On the nervous system, hydrastis, especially the alkaloid hydrastia, has effects somewhat alike, but less than those of quinine; but it appears to be devoid of toxic power.

THERAPY.—*Stomatitis*, both mercurial and aphthous, is much improved by local application of the fluid extract of hydrastis. When this preparation causes much smarting, it may be diluted with water. *Follicular pharyngitis*, *chronic coryza*, and even *syphilitic affections of the mouth*, *throat*, and *nares*, may be much benefited or even cured by the same application. It is said that five to ten drops of the fluid extract, taken by the stomach, will act favorably in the removal of the very troublesome affections named above, but the author is unable to verify these observations.

Hydrastis is very useful as a *stomachic tonic*, and may take the place of calumba in the treatment of *atonic dyspepsia.* A few drops of the tincture or fluid extract (five to fifteen) taken before meals, daily, for some time, will often cure *chronic gastric catarrh*, and remove the distressing headache which frequently accompanies this disease. It is one of the best remedies for the *stomach catarrh of chronic alcoholism*, and is probably the best substitute, if given in sufficient doses, for the alcoholic stimulant when its habitual use is to be abandoned. *Catarrh of the duodenum* is in a similar manner relieved by hydrastis, but this agent has special utility in duodenal catarrh when accompanied by *catarrh of the gall-ducts and jaundice.* Its use should, in these affections, be continued for some time. When a catarrhal state of the cystic duct—often resulting from or aggravated by catarrh of the duodenum—leads to inspissation of the bile and crystallization of the cholesterine, decided benefit accrues from the use of the preparations of hydrastis.

When *constipation* is dependent on deficient secretion, and the stools are dry and hard, it may be overcome by this remedy, but torpor of the muscular layer of the intestine is not affected by it.

Chronic catarrh of the intestine, even when it has proceeded to ulceration, is sometimes remarkably benefited by hydrastis. When the stools are very frequent and there is much pain, it is advantageous to combine a little opium with it. In *fissure of the anus*, *hæmorrhage from the rectum*, and *ulceration of the rectal mucous membrane*, applications of fluid extract of hydrastis to the affected parts promote healing.

The alkaloid hydrastia may be used as a substitute for quinia in many of the conditions for which the latter is now so frequently prescribed, viz., to promote appetite and digestion, and to improve assimilation in cases of *debility*, in *convalescence from acute diseases*, in the various *cachexiæ*, especially the paludal.

As a remedy for *intermittents*, hydrastia ranks next to quinia. It should be given under the same regulations as those which govern the administration of quinia, to the physiological and therapeutical action of which it is closely allied. The hydrastin of the eclectics, which is really muriate of berberine, is also a remedy of value in intermittents. The fluid extract of hydrastis contains, of course, both alkaloids. In chronic malarial poisoning (paludal cachexia), hydrastia and berberine may be given with ferruginous preparations, as quinia is so frequently employed. It exerts the same power, though less in degree, which quinia has over enlarged spleen of malarial origin.

The preparations of hydrastis are used with advantage in certain affections of the genito-urinary organs. In *chronic Bright's disease*, it appears to lessen the excretion of albumen. It diminishes the mucus in *catarrh of the bladder*. It is often the most efficacious remedy which we can employ in *gonorrhœa* after the acute stage has subsided, and in *gleet*. Especially in the latter has the author witnessed excellent results from its employment. The local use of hydrastia, or of the fluid extract of hydrastis, should be conjoined with the internal administration. The author has seen no injection so frequently successful in gonorrhœa as hydrastia. ℞. Hydrastiæ, ʒ j; mucil. acaciæ, ℥ iv. M. A half-ounce as an injection. Or the fluid extract, diluted to one-half or three-fourths with water, may be used for the same purpose. It is also a useful medicine in the treatment of *spermatorrhœa*, *prostorrhœa*, or *urethral leucorrhœa*.

Uterine and vaginal leucorrhœa, *ulcerations*, and *erosions* of the *cervix uteri*, are quickly improved by the topical application of the fluid extract of hydrastis, which may be used in an undiluted state.

Unhealthy and *sloughing sores*, *chancroid*, old *ulcers* of the leg, are improved in character by the local use of this remedy. To prevent septic decompositions in wounds or cavities communicating with the external air, it may be freely used by local application and injection. It has also been used, apparently with benefit, to the surface of *cancerous growths*; but the only influence it can have in this disease is to relieve fetor by preventing decomposition.

Authorities referred to:

PORCHER, Dr. F. PEYRE. *Resources of the Southern Fields and Forests*, Charleston, 1869, p. 15.

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CINCHONA AND ITS PREPARATIONS.

Cinchona Flava.—Yellow cinchona (calisaya-bark). The bark of Cinchona calisaya. It should contain not less than two per cent. of alkaloids, which yield crystallizable salts.

Cinchona Pallida.—Pale cinchona. The bark of Cinchona condaminea, and of Cinchona micrantha.

Cinchona Rubra.—Red cinchona. The bark of Cinchona succirubra. It should contain not less than two per cent. of alkaloids, which yield crystallizable salts.

PREPARATIONS.—*Decoctum Cinchonæ Flavæ.* Decoction of yellow cinchona (℥j—Oj). Dose, ℥ss—℥j or more.

Decoctum Cinchonæ Rubræ.—Decoction of red cinchona (℥j—Oj). Dose, ℥ss—℥j or more.

Extractum Cinchonæ.—Extract of cinchona (cin. flava). Dose, gr. j—x.

Extractum Cinchonæ Fluidum.—Fluid extract of cinchona. Dose, m. x—ʒj or more.

Infusum Cinchonæ Flavæ.—Infusion of yellow cinchona (cinchona, ℥j; aromatic sulphuric acid, ʒj; water, Oj). Dose, ℥ss—℥ij.

Infusum Cinchonæ Rubræ.—Infusion of red cinchona (cinchona, ℥j; aromatic sulphuric acid, ʒj; water, Oj). Dose, ℥ss—℥ij.

Tinctura Cinchonæ.—Tincture of cinchona (yellow cinchona, ℥vj—Oj). Dose, ʒss—ʒij.

Tinctura Cinchonæ Composita.—Compound tincture of cinchona (red cinchona, ℥iv; bitter orange-peel, ℥iij; serpentaria, grs. ccclx; alcohol and water, Oijss). Dose, ʒj—℥ss.

Cinchoniæ Sulphas.—Sulphate of cinchonia; occurs in white shining crystals; dissolves in fifty-four parts of cold water, in much less boiling water, in seven parts of alcohol, and very sparingly in ether. Dose, gr. v—ʒss.

Quiniæ Sulphas.—Sulphate of quinia; occurs in colorless, very light, and silky crystals; is entirely dissolved by about seven hundred and forty parts of cold, or thirty of boiling water, is readily soluble in alcohol, and in water acidulated with sulphuric acid, but is insoluble in ether. Dose, gr. j—℈j.

Quiniæ Valerianas.—Valerianate of quinia. A colorless salt, crystallizable, and having a peculiar odor and bitter taste; is soluble in one hundred and ten parts of cold, or in forty parts of boiling water, and in six parts of cold alcohol. Dose, gr. j—℈j.

Pilulæ Quiniæ Sulphatis.—Pills of sulphate of quinia. Each pill contains one grain.

Unofficinal Salts of Quinine.—Kinate, tannate, citrate, acetate, tartrate, phosphate, nitrate, hydrochlorate, arseniate, ferrocyanate, picrate, etc. There is no special advantage to be derived from the use of these salts. The curative value of the preparations of quinine depends on the base and not on the acid combined with it. Binz and the Continental physicians generally prefer the hydrochlorate.

COMPOSITION.—Cinchona is remarkable for the number and variety of the principles obtained from it, viz., five alkaloids, two simple acids, two tannic acids, and a resinoid substance. The most important alkaloid is *quinia*, which exists in all varieties of bark, but is most abundant in the yellow or calisaya bark. It occurs in combination with kinic and kino-tannic acids. *Quinidia* is an alkaloid isomeric with quinia, and may be used as a substitute for the latter in the same dose. It is less bitter than quinia, and its sulphate is more soluble in water. *Cinchonia* is found in greatest quantity in the pale barks. It unites with acids to form salts, of which the sulphate is most frequently used. Therapeutically considered, cinchonia has about half the strength of quinia. *Cinchonidia* is an alkaloid isomeric with cinchonia as quinidia is with quinia. *Aricina*, which has close analogies with cinchonia, has been found in the aricia or Cusco bark.

The alkaloids are combined in bark with the acids *kinic* and *kinovic*, chiefly with the former. There are also two kinds of tannic acid, *kino-tannic* and *kinovi-tannic*, and a resinoid substance, *kinovine*. None of these have thus far been applied to therapeutical purposes, except kinic acid, which has been utilized to form a kinate of quinia, under the belief that a combination of quinia in its natural state would be more efficient as a remedy than as combined with a mineral acid.

When the mother-liquor, left after the crystallization of the alkaloids, is evaporated, a black residue is obtained, which is called *chinoidine*. This contains amorphous quinia and cinchonia, and probably also quinidia and cinchonidia. It is a very efficient anti-periodic, and may be used with advantage as a substitute for quinia, in doses about twice as large.

With regard to the quantity of the alkaloids contained in the barks respectively, it may be stated that the three varieties—pale, yellow, and red—differ only in the relative proportions of their constituents. The pale bark contains most cinchonia, the yellow most quinia, and the red an equal proportion of each.

Administration.—The alkaloids of bark are intensely bitter. Quinia being insoluble in the saliva, is less objectionable than its salts. The sweet principle of liquorice covers the taste of the cinchona alkaloids. A sufficient dose of quinia may easily be inclosed in a chocolate caramel. The sugar-coated pill, when freshly prepared and by a reputable maker, is a convenient and suitable form for administration; but by keeping it becomes hard and insoluble. The most active form is a solution, the quinia being dissolved by the aid of sufficient dilute acid. For hypodermic use, the following formula may be followed: ℞. Quiniæ sulphat., ʒ j; morphiæ sulph., gr. ss; acid. sulphur. dil., m. xl; aquæ destil., ℥j. M. Filter. Sig. Sixty minims contain seven and a half grains. Lente's solution is the following: ℞. Quiniæ bisulph., grs. l; acid. sulph. dil., m. c; aquæ font., ℥ j; acid. carbol. liq., m. v. Solve. The quinine is dissolved by the aid of heat, and after filtration the carbolic acid is added.

Antagonists and Incompatibles.—Substances containing tannic acid in a free state should not be administered with the *infusum* or *decoctum cinchonæ*. The preparations of iodine (tincture and compound solution) are also incompatible, for they form insoluble compounds with the cinchona alkaloids. The alkalies, alkaline carbonates, and alkaline earths, should not be administered with the solutions of the alkaloids, because the latter will be precipitated.

As an agent promoting constructive metamorphosis, cinchona and its alkaloids are therapeutically antagonized by mercury, the iodides, the salts of copper, zinc, and lead.

As Gubler has shown, morphia and quinia are antagonists in respect to their effects on the brain. As regards their action on the sympathetic system, on the heart, and on the temperature, quinia, and belladonna and its alkaloid, are antagonistic.

Synergists.—All those agents which promote constructive metamorphosis, as the bitters, the ferruginous preparations, arsenic, and the acids, are synergistic to cinchona.

Physiological Actions.—The preparations of cinchona are known as "astringent bitters:" they contain, in addition to bitter principles, two tannic acids. As bitters they act as stomachic tonics; that is, promote appetite, the flow of gastric juice, and the digestive power. Long continued, as is the case with all the other bitters, they set up a gastric catarrh, and digestion becomes painful and labored. They differ from the simple bitters in exercising an astringent action on the intestinal mucous membrane, and cause constipation. The red bark is more decidedly astringent than the yellow or pale bark.

Cinchona is antiseptic. Dusted over unhealthy wounds it arrests putrefactive decomposition, and promotes healthy cicatrization. Quinia is very destructive of the minute organisms, the presence of which seems necessary to fermentative changes, and hence, when added to wine, milk, butter, etc., will prevent decomposition.

The cinchona alkaloids diffuse into the blood with great facility. As contained in the bark, they are readily dissolved out by the acid of the gastric juice. If any portion of bark or its alkaloids fail to be absorbed in the stomach, and pass into the intestine, it will be, most probably, excreted and escape with the fæces; for the alkalinity of the intestinal juices will hinder absorption or prevent it entirely.

Introduced under the skin or thrown into any of the great cavities, quinia is readily absorbed by the blood. Notwithstanding the alkalinity of the blood, quinia is held easily in solution in it, probably, as has been shown, by the aid of the carbonic acid. Recent researches have, quite accurately, demonstrated the nature of the action of quinia on certain constituents of the blood. It is a protoplasmic poison, and arrests the amœbiform movements of the white corpuscles. Ordinary medicinal doses do not have the power to prevent the migration of the white corpuscles, and the arrest of action of these bodies is a toxic effect. Quinia also affects the function of the red blood-globules as carriers of active oxygen (ozone), and diminishes the oxidizing power of the blood. When added to blood drawn from the body, it prevents the acid fermentation which takes place under ordinary circumstances, and it does this by preventing oxidation.

The foregoing facts with regard to the action of quinia on the red blood-globules, and on the ozonizing action of the blood, seem contradictory of the statements which have been made regarding the elimination of urea and uric acid. Quinia greatly lessens the excretion of uric acid, and, according to some, also of urea. The author has ascertained, as he believes, that while quinia lessens the excretion of uric acid, it does not diminish the excretion of urea.

When administered in the physiological state, quinia does not affect the temperature of the body to an appreciable extent. It is said to prevent that rise of temperature which follows active exercise. In fevers and inflammatory diseases, it diminishes to some extent the heat, but very large doses are necessary to effect much reduction. Its antipyretic action is most conspicuously shown in malarial fevers; but, in this case, the action is specific.

In small doses cinchona and its alkaloids, like the bitter tonics in general, increase a little the action of the heart, and elevate the arterial tension. In large doses quinia depresses the action of the heart, diminishes the blood-pressure, and enfeebles while it slows the pulse.

Quinia diffuses into the various parts of the organism with great rapidity. The fluorescent property of the animal tissues (animal chinoidine (Bence Jones) is quickly increased by it, and a positive gain of fluorescence is observed in the crystalline lens in a half-hour after the administration of a dose. The symptoms produced by it are those known as "cinchonism." In small medicinal doses—probably due in part to the increased cerebral circulation—some exhilaration of mind is one result of its administration. As, however, the quinia accumulates in the brain, a sense of fullness in the head, a band-like feeling about the forehead, *tinnitus aurium*, giddiness, and vertigo, are experienced. Deafness occurs when considerable doses are taken, and permanently impaired hearing may result from the use of an excessive quantity. Amblyopia and amaurosis may be produced by full doses. When a poisonous dose is given, all of the above symptoms are intensified. There are intense headache, dilated pupils, delirium, coma, and convulsions. The lethal dose of quinine has not been accurately determined, and probably varies with individual susceptibility to its action, and with the tolerance of its presence by the stomach. As several drachms are given by the French physicians in twenty-four hours in acute rheumatism, a drachm-dose cannot be toxic.

Quinia diminishes the reflex function of the spinal cord. It has been alleged to have an oxytocic effect, but the evidence which has been published in support of this statement is by no means satisfactory. Nevertheless a prudent practitioner will use quinia, in large doses, with caution in pregnant women.

The maximum effect of quinia is attained in about five hours, but it begins to appear in the urine in about a half-hour after its administration. Elimination takes place slowly, chiefly by the kidneys, but also by other channels, and is not completed under forty-eight hours; but the principal portion is excreted in twelve hours. A portion, probably, disappears in the organism, increasing the animal chinoidine. It may appear to be a work of supererogation to notice the popular fallacy that quinia, like mercury and lead, remains combined with the textures of the body: this can be possible only under the conditions above mentioned.

Therapy.—A solution of quinia will sometimes, when applied to the nares, arrest an attack of *summer catarrh*, a malady which appears to be produced by the pollen of plants. The preparation most suitable for this purpose is an aqueous solution of the hydrochlorate (gr. iv—gr. viij—℥ j). This should be applied by a large camel's-hair brush, or spray-producer, to the nares and fauces. The utility of quinine in this peculiar disease will be determined by the extent to which the local trouble has proceeded; it can be useful only when the irritation is confined to the nares and fauces.

The *aphthous ulceration* (*muguet*) which succeeds to an exhausting entero-colitis, or which occurs in cachectic infants, is much improved by quinia—a grain or two every three hours. An attack of *acute tonsillitis* may sometimes be aborted by a full dose of quinine (ten to fifteen grains). This practice is especially indicated in those cases which proceed to suppuration, but the quinia must be administered before pus forms.

The preparations of cinchona are much used as stomachic tonics. In *atonic dyspepsia* they are employed, like the simple bitters, to promote the flow of gastric juice. In *gastric catarrh* they relieve that morbid state of the mucous membrane on which the increased production of mucus depends. For these purposes they may be combined with the mineral acids. The best preparation is the infusion; the decoction, although officinal, is inelegant and faulty. The alkaloid quinia is frequently used for the same purposes, and notably in the *gastric catarrh of drunkards*, combined with acids. When vomiting of yeast-like material is due to the presence of *sarcina*, quinia may be used in virtue of its power as a poison to these minute organisms, and as an anti-ferment. In these stomach-disorders other and less expensive drugs may be used with equal advantage. (*See* HYDRASTIS.) When there is a relaxed state of the gastro-intestinal mucous membrane, manifested by catarrh, diarrhœa, etc., but without inflammation, the preparations of red bark are more particularly indicated in virtue of the tannins which they contain. The reader need hardly be reminded that the preparations of cinchona are contraindicated in all inflammatory states of the intestinal mucous membrane. Furthermore, if too long continued they will set up an irritation, and perpetuate the troubles which they were prescribed to remove.

Sometimes it happens that the *entero-colitis* of children (cholera infantum), which resists every possible combination of astringent and laxative, will yield readily to quinia. The author has seen quinia give prompt relief in the following: A child suffers with tenesmus, and after much straining voids a transparent mucus streaked with blood, but there is no fever nor other disturbance of the bowels, and the stools when passed are natural.

The preparations of cinchona and quinia are very serviceable in that state of the mucous membrane which favors the development of *ascarides.* After the expulsion of the parasites, these remedies remove the saburral state of the mucous membrane. A combination of purgatives and bitters will correct the following condition of things as they occur in children: A foul breath, coated tongue, capricious appetite, tumid belly, and constipation alternating with diarrhœa.

The use of quinia as a restorative tonic in cases of *debility* is almost universal. Given in moderate doses—six to twelve grains a day—it promotes constructive metamorphosis. Its utility is due not to any direct action on the blood, but to its stimulant effect on the digestive function, and the retardation of the combustion process. When cinchona or quinia proves irritant to the intestinal mucous membrane this beneficial restorative action ceases. Iron and arsenic increase the power of quinia to promote construction of tissue and to retard waste.

There can be no doubt in regard to the power of quinia to arrest the *inflammatory process* in its formative stages. Its utility, given with this view, ceases when the migration of the white corpuscles and the proliferation of the cellular elements of the inflamed parts have taken place, for it possesses no power to cause disintegration and absorption of inflammation products. Administered at the critical moment, a commencing *fibrinous pneumonia*, a *pleuritis*, an *endocarditis*, may be suppressed by a full dose (fifteen to twenty grains). Its power in this respect is much increased by combination with morphia. If the time have passed for the use of quinia in this way, it is employed with advantage as a restorative tonic in the various inflammatory affections of low type.

In *septic diseases* quinia has very important uses. Although the observations of Binz, showing the influence of quinia over septic processes, may not be applicable to the full extent for which he proposes them, there can be no doubt of the good effects in practice of quinia in *septicœmia*, *pyœmia*, *erysipelas*, and *puerperal fever*. In these diseases only large doses—five to twenty grains—every four hours, are useful.

The author's experience in the treatment of *acute rheumatism* does not justify the use of large doses of quinia, as now employed by Briquet and his followers in France. In the *hyperpyrexia* of acute rheumatism, it is true, large doses of quinia will depress the temperature, but we have less distressing and more effective means for accomplishing this object, in the wet-pack and the cold bath. When the acuter symptoms have subsided, and the skin is cool and perspiring, and the pulse weak, quinia in moderate doses—two to five grains—is very serviceable.

A careful examination of the large number of facts which have now been accumulated and considerable personal experience and observation, have satisfied the writer of the inutility of quinine, in the treatment of *typhus* and *typhoid fevers*. Not only has this remedy no influence over the course and duration of these affections, but its irritant effects upon the gastro-intestinal mucous membrane, and its inhibitive influence, exerted through the organic nervous system, upon the heart and lungs, render it positively injurious in large doses. As a rule the dryness of the tongue, the diarrhœa, the subsultus, and the delirium of typhoid fever, are increased by it. In certain parts of the United States, the prevalence of a mixed type—*typo-malarial*—requires, under certain conditions, the use of quinia in continued fevers. But it becomes less and less effective as the *typh-element* predominates. When there are evidently true remissions—and not merely the rhythmical morning remission and evening exacerbation characteristic of typhoid—quinia is indicated, and it is most effective when administered in an occasional large dose during the remission. When there is a condition of hyperpyrexia, and the danger to life is imminent from the excessive temperature, large doses of quinia may be given with a view to its apyretic effect, but this practice is less effective and more dangerous than cold baths.

In *cerebro-spinal meningitis*, doubtless a continued fever with cerebro-spinal lesions, quinia is indicated under the conditions already defined for the treatment of other inflammations, viz., in the beginning of the disease, when the alterations of cutaneous sensibility first occur, and before the febrile movement has developed. If a single large dose —twenty to thirty grains—does not produce a good result, it is useless to repeat it, or to pursue a tentative plan with small doses.

In the treatment of the *eruptive fevers*, *variola*, *scarlatina*, *rubeola*, quinia has an important place. It is used in small doses, frequently repeated in adynamic states, and in large doses at longer intervals to correct hyperpyrexia. In scarlet fever, Dr. Hood especially urges the use systematically of quinia from the earliest stage of the disease, preceded by an emetic and purgative, and he states as the result of this practice that since he has adopted it he has not lost a single case of this disease treated by him from the beginning. In measles, large doses of quinia have an unquestionable utility in relieving the catarrhal pneumonia, and in preventing those changes in the exudation products which end in caseation.

The most important uses of quinia are those which, in the present state of our knowledge, cannot be deduced from a study of its physiological actions, viz., the cure of *malarial diseases*. It is true, the toxic action of quinia on minute organisms is supposed by Binz and his followers to be the true explanation of its *methodus medendi*, but the exact influence of these organisms in the causation of malarial diseases has not hitherto been defined.

Quinia is used to prevent *malarial infection*. Numerous instances have been reported in which those using quinia as a preventive of malarial poisoning have experienced an exemption from malarial diseases when exposed to the most deadly miasm. According to most authorities, the protective influence does not decline by repeated use. From five to ten grains each morning is the quantity usually required. The author is convinced that it is better to begin with the minimum dose, and add a grain each week during the whole period of exposure. The quinia is frequently given in wine, whiskey, or other alcoholic stimulant, but this is unnecessary, if not harmful; it had better be given in some black coffee, or in a chocolate caramel. The quinia should be taken not only during the period of exposure, but for ten days or two weeks subsequently.

The mode of use of quinia for the cure of *intermittents* may be formulated as follows:

The anti-periodic is equally effective, whether administered in the interval or during the seizure.

If time is an element of importance, no delay is necessary in order to give the remedy in the stage of apyrexia.

To save the suffering and exhaustion of the febrile movement, the attack should be anticipated, and, if possible, prevented.

As the maximum effect of the quinia is attained in about five hours after being taken, it should be administered this period of time, at least, before the expected paroxysm.

As the elimination of quinia takes place with considerable rapidity, the maximum curative effect is obtained by the administration of the whole amount required in a single dose, rather than by a succession of small doses (Prize Essay).

An intermittent may be successfully treated by giving, during the interval, a number of small doses frequently repeated. The author is convinced by extended observation that a full dose of quinia (ten grains) in the sweating stage, and the same quantity five hours before the time of the next paroxysm, is the more effective method. The anti-periodic property of quinia is increased, and the cerebral effects of large doses diminished, by combination with morphia. It is well known that intermittents, arrested by quinia or other anti-periodics, manifest a tendency to recur about the septenary periods; therefore, ten to fifteen grains of quinia should be administered in anticipation of these recurrent paroxysms, until the third septenary period has passed. Meanwhile, the organs damaged by the malarial infection—intestinal canal, liver, spleen, kidneys, etc.—require appropriate treatment. The action of quinia is much assisted by the continuous administration of arsenic during the intermissions, and until the third septenary period has passed.

If an irritable state of the stomach prevent, quinia may be administered in solution by the rectum, or hypodermically.

In the treatment of *remittent fever* two modes of using quinia are employed: first, by emetics, purgatives, baths, diaphoretics, etc., to secure a distinct remission when the remedy is administered; second, to give it in sufficient dose immediately, relying on its apyretic effect. The author is convinced that the latter plan is preferable: from twenty to thirty grains in a single dose once or twice each day until the temperature is reduced to normal. This use of the remedy need not interfere with other appropriate medication.

In the so-called *pernicious fever*, it is agreed on all hands that the safety of the patient is secured only by the prompt use of large doses (twenty to sixty grains) and administration by the stomach, rectum, and skin, may be in turn or simultaneously resorted to.

In *chronic malarial infection*, important changes have been produced in the intestinal canal, liver, spleen, kidneys, cerebro-spinal axis; the paroxysms of fever occur irregularly; various abnormal manifestations of the infection take place (dumb ague, enlarged spleen, etc.). Under these circumstances, quinia is less curative than when the infection is recent, and the paroxysms will recur from time to time notwithstanding its use, unless these structural alterations are corrected. In chronic malarial disease, chinoidine is rather more effective than quinia. ℞. Chinoidine, ʒj; acidi arseniosi, gr. j; ferri sulph. exsic., ℈j. M. Ft. pil. no. xx. Sig. One pill three times a day. Or the following: ℞. Chinoidine, ʒj; hydrastia, ʒij; ferri sulph. exsic., ℈ij. M. Ft. pil. no. lx. Sig. Two pills three times a day. ℞. Quiniæ sulph., chinoidine, hydrastiæ, āā ʒj; res. podophylli, gr. x; ferri sulph. exsic., ʒss. M. Ft. pil. no. lx. Sig. Two pills three times a day.

In *periodical affections of malarial origin*, quinia is equally as effective as in the periodical febrile diseases, but somewhat larger doses are necessary. A difficulty of diagnosis often arises in these diseases, for the reason that the neuroses are irregularly periodical in their manifestations, when not malarial in origin. The existence of a malarial cachexia, and the more uniform periodicity in the recurrence of the paroxysms, will enable the practitioner to distinguish the neuroses of malarial origin from the other functional disorders of the nervous system. The following group contains the disorders of the sensory nervous system caused by malaria: tic-douloureux, cephalalgia, cervico-brachial neuralgia, cervico-occipital neuralgia, dorso-intercostal neuralgia, lumbo-abdominal neuralgia, mammary neuralgia, crural neuralgia, gastralgia, enteralgia, hepatalgia, nephralgia, hysteralgia, ovaralgia, sciatica, angina pectoris.

The following motor disorders, also, are produced by malarial influences: epilepsy, chorea, stricture of urethra, hiccough, laryngismus stridulus, asthma, summer catarrh.

These neuroses may occur as an expression of malarial infection, being substituted for the ordinary chill, fever and sweat, or they may assume the orderly periodical character in consequence of having occurred in an organism already under the influence of the malarial cachexia. If they are of malarial origin, the specific action of quinia will speedily prevail against them. These malarial neuroses require large doses of quinia, and the same fact is true of all irregular manifestations of malarial infection. Ten to twenty grains, according to the severity of the attacks and the obstinacy with which they recur, are necessary, and the paroxysms should be anticipated by the exhibition of the remedy from three to five hours before the expected time. In cases of malarial neuralgia, the curative effect of quinia is enhanced by combination with morphia, either in the same prescription or by simultaneous administration of the latter subcutaneously.

Diarrhœa, dysentery, jaundice, and hypertrophy of the spleen, occasionally occur in the periodical form, or are due to the immediate influence of paludal miasm. Under these circumstances, quinia affords relief without the use of any other remedy. Very frequently the diarrhœa, dysentery, and jaundice, are results of structural alterations in the liver, and the glandular apparatus of the intestine, and are not merely functional disorders which quinia may remove. In malarial enlargement of the spleen, quinia is supposed to be especially effective; but quinia exhibits a curative power only in cases of simple enlargement, and does not affect that condition known as "fleshy spleen," or chronic splenitis.

Hœmaturia when distinctly intermittent, and arising from malarial infection, is cured by quinia, but large doses are necessary.

Cases of *cerebral disease*, occurring in weak and anæmic subjects, are sometimes much improved by small doses of quinia. The author has observed great relief by the use of this remedy in the following group of symptoms, occurring in men advanced in life: Headache, vertigo, failure of memory, and despondency, associated with a slow pulse, an atheromatous degeneration of the vessels, puffiness of the eyelids, and dilatation of the superficial veins of the head. From three to ten grains daily may be given with advantage, the effect being to remove that sluggishness of the intra-cranial circulation on which these symptoms depend. In *insanity*, especially the *puerperal form*, when there is much weakness, and the skin is cold and sweating, quinine is very useful. When there is a condition of adynamia—the usual state—in *delirium tremens*, small doses of quinia assist materially in tranquillizing the patient. In that preliminary stage known as "horrors," characterized by restlessness, tremor, nausea, and anorexia, quinia, with a mineral acid, renders important service by restoring the digestive function, and by giving steadiness to the cerebral motor centres.

Although headache (hemicrania) and neuralgia of malarial origin are cured by quinia, by no means equally successful results follow the use of this remedy in ordinary headache and neuralgia. Quinia is largely employed, it is true, in these affections when not caused by malaria, but it is useful only when anæmia is present and is causative. The same remark is true of *epilepsy* and *chorea*.

An attack of *acute catarrh* may often be entirely aborted by a full dose (ten grains) of quinia and morphia (one-half a grain), if given at the incipiency of the attack. After the acute symptoms have subsided, quinia is very serviceable in *hay-asthma*. *Diphtheria* being an adynamic disease, quinia is used by the stomach with a view to its restorative action, and in the form of spray to arrest the spread of the exudation in the fauces. The power of quinia to kill bacteria and micrococci renders its local use a rational measure in a disease characterized by an enormous multiplication and diffusion of micrococci.

Laryngismus stridulus, a reflex spasm of the muscles of the larynx occurring in rickety, ill-fed, and anæmic children, may be prevented recurring by the use of quinia in the intervals between the attacks. Quinia is one of the remedies which is used in *membranous croup*, but the reported successes were probably cases of spasmodic croup. There can be no doubt regarding the good effects of quinia in *asthma*, after the severity of the paroxysms has somewhat abated, as an apyretic in the fever which succeeds, and as a restorative tonic. It is, also, the most useful tonic which can be employed in *chronic bronchitis*, with profuse expectoration (bronchiectasis). The hectic fever and sweats of *phthisis* are prevented by large doses (fifteen to twenty grains) of quinia, but this remedy really has no influence over the course and progress of the disease.

In *skin-diseases*, when there is present a lowered condition of the vital forces, quinia is indicated. It is the most valuable remedy in *erysipelas* and *erythema nodosum.* It is a curious fact that in many subjects a full dose of quinia will cause an erythema, with dilated pupils, phenomena closely analogous to those produced by belladonna. *Ecthyma* and *impetigo*, usually arising in a feeble state of the assimilative functions, are cured by quinia.

Quinia is largely employed in *surgical affections*, to sustain the powers of life during protracted suppuration, and to check the formation of pus. It is the most generally prescribed remedy for *surgical fever.* A full dose of quinia, given before the operation, may prevent the chill and fever which succeed in some subjects to the operation of *catheterization.*

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AGENTS PROMOTING DESTRUCTIVE METAMORPHOSIS OR INCREASING WASTE.

ALKALIES.

Potassium.—PREPARATIONS: *Potassa.*—Potassa; *potasse*, Fr.; *Kali hydricum*, Ger. Caustic potash. Occurs in cylindrical rods, is very deliquescent, and dissolves in water and in alcohol.

Potassii Acetas.—Acetate of potassium. A white deliquescent salt, wholly soluble in water (100 in 35) and in alcohol (proof spirit 1 in 2). Dose, grs. v—℈j.

Potassii Bicarbonas.—Bicarbonate of potassium. In white crystals, permanent in the air, wholly soluble in water (1 in 3), and having a slightly alkaline taste. Dose, grs. v—℈j.

Potassii Carbonas.—Carbonate of potassium.

Potassii Carbonas Pura.—Pure carbonate of potassium. Deliquescent salt, wholly soluble in water (100 in 75). Dose, grs. ij—grs. x.

Liquor Potassii Citratis.—Solution of citrate of potassium. Dose, ʒj—℥j.

Potassii Citras.—Citrate of potassium. A whitish, granular, deliquescent salt, wholly soluble in water (10 in 6). Dose, grs. v—ʒss.

Potassii Tartras.—Tartrate of potassium. In white crystals, which are somewhat deliquescent, and are wholly and readily soluble in four parts of boiling water. Dose, grs. v—℈j.

Potassii et Sodii Tartras.—Tartrate of potassium and sodium—Rochelle salt. In colorless, transparent crystals, which effloresce slightly in dry air, and are wholly and readily soluble in five times their weight of boiling water. Soluble in cold water, 1 in 2.

Liquor Potassæ.—Solution of potassa. A colorless liquid, having an extremely acrid taste, and a strong alkaline reaction. Dose, m. ij—m. xx. It should be taken well diluted with water.

Potassii Chloras.—Chlorate of potassium. In colorless, tabular crystals, which have a pearly lustre, and are wholly soluble in distilled water (in cold water, 1 in 12; in boiling water, 1 in 2). Dose, grs. v—℈j.

Trochisci Potassii Chloratis.—Chlorate of potash troches.

Potassii Nitras.—Nitrate of potassium. In colorless, prismatic crystals, unalterable in the air, and wholly soluble in water (in cold water, 1 in 4; in boiling water, 1 in 2½). Dose, grs. ij—grs. x.

Potassii Bichromas.—Bichromate of potassium. In orange-red, anhydrous, tabular crystals, soluble in ten parts of cold, and in much less of boiling water, forming a solution having an acid reaction. Dose, [illegible]

Potassii Bitartras.—Cream of tartar. Is sparingly dissolved by water (in cold water, 1 in 200; in boiling water, 1 in 18). Dose, grs. v — ʒ j, or more.

Sodium.—*Soda.*—Soda; *Natrium*, Ger.; *soude*, Fr. Occurs in irregular flat masses. Is soluble in water and in alcohol.

Liquor Sodæ.—Solution of soda. A colorless liquid, having an extremely acrid taste, and a strong alkaline reaction. Dose, m. ij—m. x.

Sodii Acetas.—Acetate of soda. In white or colorless crystals, which effloresce in dry air, and are wholly soluble in water. Dose, grs. v— ʒ j.

Sodii Bicarbonas.—Bicarbonate of sodium. A white opaque powder, wholly soluble in water (1 in 10). Dose, grs. v— ʒ j.

Sodii Boras.—Borate of sodium. Borax. In colorless crystals, which slightly effloresce in dry air, and are wholly soluble in water. Dose, grs. ij—℈ j.

Sodii Carbonas Exsiccata.—Dried carbonate of sodium. Dose, grs. ij—grs. x.

Pulveres Effervescentes.—Effervescing powders. Each powder contains thirty grains of bicarbonate of sodium in one paper, and twenty-five grains of tartaric acid in the other paper.

Pulveres Effervescentes Aperientes.—Aperient effervescing powders. Seidlitz powders. Each powder contains forty grains of bicarbonate of sodium, and one hundred and twenty grains of tartrate of potassium and sodium (Rochelle salt) in one paper, and thirty-five grains of tartaric acid in the other paper.

Calcium.—*Calx.*—Lime; *Kalk*, Ger.; *chaux*, Fr.

Calcii Carbonas Præcipitata.—Precipitated carbonate of calcium. A fine, white powder, insoluble in water. Dose, grs. v—℈ j.

Creta Præparata.—Prepared chalk. Dose, grs. v—℈ j.

Liquor Calcis.—Lime-water.

Liquor Calcis Saccharatus.—Dose, ʒ ss— ʒ ij (unofficinal).

Testa Præparata. Prepared oyster-shell. Dose, grs. v—℈ j.

Mistura Cretæ.—Chalk-mixture. Dose, ʒ j— ℥ ss.

Lithium.—Lithium.

Lithii Carbonas.—Carbonate of lithium. A white powder, sparingly soluble in water (1 in 100), and having a feeble alkaline reaction. Dose, grs. ij—grs. x.

Lithii Citras.—Citrate of lithium. A white powder, deliquescent, and soluble in twenty-five parts of water.

ANTAGONISTS AND INCOMPATIBLES.—The alkalies and their carbonates are incompatible with the acids, with acidulous salts, and with metallic salts. The caustic alkalies decompose the alkaloids of belladonna, stramonium, and hyoscyamus. In cases of poisoning, the antidotes to be employed are the vegetable acids—acetic, citric, or tartaric acids—in the form of vinegar, cider, lemon-juice, etc. Demulcents and the fixed oils limit the corrosive action of the caustic alkalies, and should therefore be given freely.

SYNERGISTS.—The alkalies assist each other's action. All agents promoting waste—for example, mercury, the iodides, etc.—increase the therapeutical activity of alkalies.

PHYSIOLOGICAL ACTIONS.—The chemical position of the alkalies is the most important factor in their physiological action. They combine with acids to form salts, and with fat to form soap, and they dissolve albumen; hence, when the caustic alkalies are brought into contact with the animal textures, they destroy them. Alkalies increase the production of saliva. In the stomach they undoubtedly obey chemical laws, and neutralize any free acid contained in that organ. As the acidity of the gastric juice is essential to digestion, it is obvious that the frequent ingestion of alkali must be harmful. Given on an empty stomach, it is now known that alkalies promote the acidity of gastric juice, by favoring the outward osmosis of those constituents of the blood from which the acid of the stomach is elaborated; but as a large amount of alkali will neutralize a corresponding proportion of acid, it is obvious that, to obtain an increased quantity of acid, the amount of alkali administered must be small.

As the alkalies are very diffusible, they pass into the blood with facility. In the liquor sanguinis they do not exist in the free state, but in the form of saline compounds, as albuminates, carbonates, and also phosphates. The presence of loosely-combined alkalies in the blood, and the simultaneous presence of oxygen, insure the gradual oxidation of the organic constituents of that fluid. The organic acids, especially when combined with alkalies, decompose in the presence of an excess of alkali and of oxygen. There can be no doubt that the albuminous elements of the blood, the carbo-hydrates, the fats, are similarly oxidized, although the process is by no means a rapid one. It results from these facts, that alkalies promote the destruction or the retrograde metamorphosis of some of the most important constituents of the blood. It follows, further, that, as the blood, an alkaline fluid, is surrounded by acid fluids, rapid interchanges must be continually taking place, and oxidation promoted in the tissues. Hence the increased consumption of the tissues, or the wasting, which is caused by the long-continued use of alkalies. It is true, alkalies, by disordering digestion, may also impair the constructive energies of the organism, but, that they directly promote waste in the manner indicated above, seems undoubted.

The potash alkalies must be grouped with the cardiac poisons; they lower the blood-pressure, the temperature, the action of the heart. The caustic alkalies cause death by the violent gastro-enteritis produced by their corrosive action; but the depression of the powers of life, which is so marked a phenomenon, is probably due in part to the influence of these poisons on the spinal cord, as well as on the cardiac muscle.

The alkalies are eliminated, chiefly, by the kidneys, the combinations with vegetable acids undergoing decomposition, while the salts of the mineral acids are probably excreted unchanged. The urine is rendered alkaline by large doses of the acetates, citrates, and carbonates. The water of the urine is increased by these salts; hence they are known as *diuretics*. The alkalies, also, increase the excretion of solid matters —the urea, uric acid, and extractive matters. In other words, they cause the elimination of the products of the increased metamorphosis of tissue. It follows that the alkalies diminish the body-weight, impair the quality of the blood, and lower the forces of the organism. These results are not unfrequently seen after the alkaline treatment of acute rheumatism.

THERAPY.—Chlorate of potassa is much used as a local application to *ulcerous disease* of the mouth, *follicular pharyngitis*, etc. ℞. Potass. chlorat., ʒj; acid. carbol., ʒss; aquæ destil., ℥iv. M. Sig. Lotion. There is no more effective remedy for *ulcerative stomatitis*, the *stomatitis* of nursing women, and *aphthæ*. In these diseases it may be applied directly to the affected part, and administered by the stomach. As a rule, the largest doses are necessary (10 grs—℈j), especially in nursing sore mouth. The author has seen but little result from the use of chlorate of potassa in *mercurial stomatitis*.

The alkalies are used with great advantage in many stomach-disorders. It is an undoubted chemical fact that an *excess of acid* is relieved by an alkali, but the result is not permanent and the cause of the acidity is not removed. Small doses of an alkali, given with a bitter before meals, promote the flow of gastric juice, and are a serviceable combination in *atonic dyspepsia*. ℞. Inf. calumbæ, ℥iv; liq. potassæ, ʒss. M. Sig. A dessert to a tablespoonful three times a day before meals. Administered after meals, the alkalies will relieve the acidity due to an excessive production of acid, or to the acid fermentation of the starch, sugar, and fat, in the food. An acid given before meals is the proper remedy for the excessive formation of the acid of the gastric juice. Alkalies render an important service in case of *indigestion of fats*. Not only do they prevent the formation of butyric acid, but they assist in the process of emulsionizing the fats and help their absorption. In diseases of the liver, and when from any cause the flow of bile into the intestine is prevented, alkalies assist in the digestion and absorption of fats. The *indigestion* of *obese* subjects, and of the *gouty* and *rheumatic*, is usually cured or alleviated by alkalies. The lithia salts are generally to be preferred in gouty and rheumatic subjects.

In cases of *poisoning* by *acids* or the *acidulous metallic salts*, alkalies are indicated. The bicarbonates, chalk, lime-water, are most suitable for this purpose.

In *vomiting* arising from irritation of the stomach mucous membrane, whether due to indigestible food, acidity, ulcer, or cancer, and in the *summer vomiting* of children, lime-water, especially when combined with new milk, will frequently succeed in giving relief when more powerful means fail. Lime-water is a useful addition to the milk given infants when it becomes acid or is vomited in large caseous masses. Chalk in the form of chalk-mixture is a useful medicine in the *diarrhœa of children.* It is indicated when the stools are sour-smelling, or when the discharges are frequent and watery. When an antacid is required in the treatment of children's diseases, and constipation exists, bicarbonate of soda is preferable to lime-water.

The *vomiting* which is so frequently attendant on *acute inflammatory diseases* and on the *exanthemata* is often much alleviated by the effervescing soda-powder. Alimentation may in this way be carried on when it is not otherwise, except by nutrient enemata, possible.

The salts of the alkalies, especially the citrates, tartrates, and carbonates, are useful in *inflammatory diseases* to lessen heat, and to promote excretion of the products of inflammation. When oxidation is deficient, as represented in an *excess of uric acid in the urine*, a coated tongue, hebetude of mind—the so-called "bilious state"—relief is afforded by the use of the alkalies and their laxative salts.

Based chiefly on theoretical considerations, the alkaline treatment of *acute rheumatism* has until very recently obtained general approval. This method consists in an attempt to alkalinize the urine by the free administration of bicarbonate and nitrate of potassium, and the internal use of these salts, aided by the application to the affected joints of strong alkaline solutions. Although the duration of the joint trouble has appeared to be shortened by this method of treatment, a dyscrasic state induced by the enormous amount of alkali renders convalescence tedious. Since the natural history of acute rheumatism has been more accurately studied, the utility of the alkaline treatment has been seriously questioned, and this method is being supplanted by quinine, the blister-treatment, and the cold bath.

The close relationship between rheumatism and *diabetes* has led to the extension of the alkaline treatment to the latter disease. By promoting oxidation, it was assumed that the surplus sugar would be burned off, and thus its escape by the kidneys prevented. The results have not justified these theoretical considerations. It is true, benefit is obtained by the use of alkalies when diabetes occurs, as it so frequently does, in very obese subjects, but its influence in these cases is limited to the troubles of digestion under which these patients suffer. Diabetes of hepatic, pulmonary, or cerebral origin, is not directly influenced by the alkaline treatment. The author has, however, seen one case apparently cured by the diligent use of carbonate of ammonium.

In *chronic rheumatism*, *rheumatic gout*, and *chronic arthritis*, good results are undoubtedly obtained by the use of the lithia salts. The bromide of lithium is the most agreeable of these preparations. When the joints are enlarged (*chronic rheumatic arthritis*), the action of the systemic remedies may be aided by the application to the affected parts of a strong solution of lithia. The author has observed excellent results from the use of bromide of lithia in cases of rheumatism, when the smaller joints remain swollen and tender after the subsidence of acute symptoms. ℞. Lithii bromidi, ʒ iij; syrup. zingiberis, ℥ ss; aquæ, ℥ iss. M. Sig. A teaspoonful three times a day. ℞. Lithii carbonat., ʒ j; acidi citrici, ʒ ij; aquæ, ℥ ij. M. Sig. A teaspoonful every four hours.

In *irritation of the urinary organs* due to an excess of acid, the combinations of the alkalies with the vegetable acids possess a high degree of utility. The liquor potassæ is much prescribed under these circumstances, but, as it is very irritating to the stomach, the salts are preferable, and they are equally effective. The liquor potassæ citratis is an excellent form for this purpose. There is no doubt that the long-continued use of alkalies (citrate, acetate, and carbonate of potassa) will effect the solution of *renal calculi*, which are usually composed of uric acid. As the urate of soda is often the nucleus of these formations, the soda alkalies should not be used. Small doses taken daily for lengthened periods are necessary. Such alkaline waters as the Vichy may be used if more agreeable to the patient, but the best results are obtained by the administration of the citrates and tartrates in a large quantity of distilled water. When the urine is acid in any of the forms of cystic irritation—from *stone*, *cystitis*, *stricture*, *enlarged prostate*, etc.—great relief is experienced from the use of alkalies, notably the liquor potassæ, the citrates, acetates, and carbonates of potassium. When the urine is alkaline in reaction, no benefit can be derived from the use of these remedies.

The bitartrate and the acetate of potassium are very certain *diuretics*, especially the first named. They are most effective when given largely diluted with water. A pleasant form in which to administer cream of tartar is the familiar "cream-of-tartar lemonade," made as follows: a sufficient quantity of the remedy is dissolved in hot water; when cold the clear solution is poured off; some lemons are cut up and put in it, and it is sweetened to the taste. This solution may be drunk *ad libitum*. Considerable stomach and intestinal distress often follows the free use of dilute solutions of these potash salts, in consequence of the abundant production of carbonic-acid gas. The potash salts are indicated as diuretics in *desquamative nephritis*, and in *general dropsy from valvular disease of the heart*. By determining a free urinary discharge in the one case, they assist in washing out the obstructing epithelium in the tubules; in the other they relieve the tension of the venous system. Very little is accomplished by the use of alkaline diuretics in dropsical accumulations in the various cavities. Influenced by theoretical considerations, Dickinson advises the use of the potash alkalies in *amyloid kidney*, or, as he terms it, *depurative disease*, to compensate for the waste of alkali in the process of suppuration.

An ingenious use of bicarbonate of sodium as an *emetic* is the following: sufficient of this salt is first swallowed, and immediately thereafter tartaric acid in suitable proportion. Brisk effervescence ensues, with the effect to empty the stomach thoroughly. This mode of producing emesis is applicable to cases of narcotic poisoning. In *intussusception* the same expedient has been employed with success, the soda and the acid being introduced, in the same order, into the rectum. It should be remembered that the sudden distention of a *softened* stomach or rectum might cause a rupture.

External Applications of the Alkalies.—A solution of common soda (impure bicarbonate) freely applied will often remove the *fetid sweat of the feet*, and the *odorous emanations which in some subjects escape from the axillary glands*. *Acne* occurring in persons with a greasy skin, and prominent and black sebaceous follicles, may sometimes be cured by alkaline lotions. ℞. Liq. potassæ, ʒ j; aquæ rosæ, ℥ iv. M. Sig. Apply with a soft sponge twice a day. For *acute eczema* where there is much serous discharge, no applications are more efficient than solutions of the alkalies. ℞. Sodii carbonat., ʒ ss; aquæ, Oj. M. Sig. The eruption to be covered with lint soaked in this solution. Stronger solutions can be used in old cases where the skin is much thickened. As alkalies, by absorbing the moisture and combining with the fat of the sebaceous matter, make the skin dry and harsh, it is useful to apply some form of oil after these alkaline applications, certainly after the stronger solutions. Mutton-suet is one of the best fats for this purpose.

In *prurigo*, great relief is often obtained by an alkaline warm bath at bedtime. A solution of carbonate of potassium (ʒ iij—℥ iv) is recommended by Trousseau as a remedy for that obstinate affection—*pruritus vulvæ*. In *freckles*, *sunburn*, and *tan*, the following lotion is useful: ℞. Potassii carbonat., ʒ iij; sodii chloridi, ʒ ij; aquæ rosæ, ℥ viij; aquæ aurantii flor., ℥ ij. M. Sig. Lotion.

To cleanse the scalp from dandruff (*pityriasis*), there is no more suitable application than a saturated solution of borate of soda. Powdered borax, mixed with sugar, is a domestic remedy for *aphthæ* of children; it is simply placed on the tongue. A saturated solution of borax in rose-water is a useful application to remove freckles, and to allay *pruritus vaginæ*.

A solution of permanganate of potassa (gr. j—℥ j) is an elegant toilet remedy for correcting *fetor of the breath*. In *ulcerous diseases of the buccal cavity* it is used to destroy foul odors, and to improve the condition of the sloughing surface. In *ill-conditioned wounds* generally solutions of this salt, in various strengths, are employed with a view to change the action, but little more is accomplished than temporary destruction of odors. There are many other agents, much less expensive and more powerful, which can be used for these purposes.

The so-called *ingrowing toe-nail* may be cured by the application to the irritable granulation, at the margin of the nail, of a solution of liquor potassæ (ʒ ij— ℥ j). This solution is to be applied on cotton-wool, to the margin of the nail and to the ulcerated surface of the toe, until the nail is so far softened that it can be cut away without pain.

Unhealthy and *sloughing ulcers* may be destroyed by potassa fusa, and a healthy granulating surface be left. No more efficient escharotic can be used in *hospital gangrene.* As it penetrates deeply and widely, great care must be used to limit its application to the affected parts, and, as soon as the destruction is sufficient, to check the further extension of the caustic by washing with a dilute acid. Vienna paste—which is a mixture of equal parts of potassa and lime made into a paste with alcohol—is milder in operation, and therefore usually preferred. Caustic potash was formerly much employed to make *issues*, to open *abscesses* and *carbuncles*, but these applications are now quite obsolete. Induration of the *cervix uteri* and *chronic metritis* (hyperplasia of the connective tissue) are, it is said (Dr. Bennet), very effectively treated by application of caustic potassa and potassa cum calce ; but such powerful means must be used with great caution, if at all. In *carcinoma*, when the disease is limited to the neck of the uterus and not too far advanced, caustic potassa may be used with advantage to destroy the diseased surface. This caustic is quite as efficient as any, probably, for the escharotic treatment of *cancer* when this method of treatment is employed.

A solution of the bichromate of potassium (gr. j — grs. x— ℥ iv), is an excellant local application in the treatment of the *catarrhal state of the nasal, buccal, or vaginal mucous membrane.* A saturated solution of this salt may be used as a caustic in place of chromic acid.

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ALKALINE MINERAL SPRINGS.

1. North America.

Bladon Springs, Choctaw County, Alabama. A rolling, pine-woods region.

They contain carbonate of soda, carbonate of magnesia, carbonate of iron, carbonate of lime, sulphate of lime, carbonic-acid gas, sulphuretted hydrogen (traces), and chlorine.

Congress Springs, Santa Clara County, California. In the Coast Range of mountains.

They contain carbonate of soda (15.418 grains to the pint?), carbonate of iron, carbonate of lime, chloride of sodium (14.894 grains to the pint), sulphate of soda, etc. They are highly charged with carbonic-acid gas.

California Seltzer Springs, Mendocino County, California.

They contain carbonate of soda, carbonate of magnesia, carbonate of lime, carbonate of iron (a trace), and chloride of sodium. They are also highly charged with carbonic-acid gas.

Perry Springs, Pike County, Illinois.

They contain carbonate of potassa, carbonate of magnesia, carbonate of iron, carbonate of lime, sulphate of soda, silicates of soda and potassa. Temperature of the water is from 48° to 50° Fahr.

St. Louis Spring, Gratiot County, Michigan.

This water contains carbonate of soda (7.684 grains to the pint), carbonate of magnesia, carbonate of iron, carbonate of lime (5.019 grains to a pint), sulphate of lime (6.925 grains to a pint), silicate of lime, and silica. This is one of the so-called "magnetic springs"—the magnetic property being due not to the water, but produced by the magnetization with terrestrial currents of the vertical iron tube through which the water flows. It is unfortunate that this part of the peninsula of Michigan, in which the numerous alkaline and saline springs abound, is very decidedly malarious.

Rockbridge Baths, Rockbridge County, Virginia. A mountainous region.

They contain magnesia and iron, with a small quantity of iodine. Temperature, 74° Fahr. Used chiefly in the form of baths.

Capon Springs, Hampshire County, West Virginia.

This water contains carbonate of soda, carbonate of magnesia, and traces of iodine and bromine. The temperature of the water is 66° Fahr. These springs are situated in a romantic mountain-region.

2. European.

Vichy, Central France.

There are several springs—*Grande Grille*, *Puits Carré*, *Hôpital*, *Celestins*, *De Mesdames*, and others. The waters contain carbonates of soda, of potassa, magnesia, and lime, sulphate of soda and chloride of soda, phosphate of soda, arseniate of soda (a trace), carbonates of strontia and iron. The gas, which is abundant, is carbonic acid.

In the Vichy region there are numerous alkaline springs having similar properties. The temperature of the waters varies from 58° Fahr. (*Celestins*) to 178° Fahr. (*Chaudes Aigues*).

Mont Dore, valley of the Dordogne, France.

The waters are weak alkaline, and have a temperature from 90° to 104° Fahr. Their principal constituent is carbonate of soda. These springs lie among the volcanic mountains of Auvergne, at an elevation of 3,300 feet.

Vals, Ardèche, France.

The waters of these cold springs are remarkable for the quantity of carbonate of soda which they contain. They are abundantly charged with carbonic-acid gas.

Ems, on the Lahn, Germany.

These waters contain, according to the analysis of Fresenius, 14 to 15 parts of bicarbonate of soda, 7 parts of chloride of sodium, and 1.7 part each of bicarbonate of lime and bicarbonate of magnesia, with sulphates of soda and potash, and bicarbonates of iron, manganese, baryta, strontia, and alumina in small quantity, to the pint. The gas is carbonic acid, from 6 to 8 cubic inches to the pint.

Neuenahr, valley of the Ahr, between Bonn and Coblentz, Germany.

The waters of these springs have a composition similar to those of Ems, but have about half as much soda and very little salt.

Salzbrunn, Upper Silesia, near Freiburg, Germany.

These waters are very rich in carbonate of soda.

Gleichenberg, near Gratz, Styria, Austria.

These springs are much more alkaline than Ems. The waters contain from 20 to 27 parts of carbonate of sodium, 19.5 of chloride of sodium, and 7.8 of carbonate of magnesium. The water is highly charged with carbonic-acid gas.

Therapeutical Uses of the Alkaline Mineral Waters.—As we have seen that alkalies taken before meals increase the production of acid gastric juice, the alkaline mineral waters are serviceable in *atonic dyspepsia*. They are especially useful in *catarrh of the duodenum and of the bile-ducts, and in the jaundice* dependent on this state of the mucous membrane. In *incipient cirrhosis, in congestion of the portal circulation, and in hæmorrhoids* due to the hepatic obstruction, they render important service. *Obesity*, which is frequently diminished by a course of alkalies, is better treated by alkaline waters, for at the springs these patients can be induced, more easily, to conform to the plan of exercise and diet necessary in these cases.

The alkaline springs have long had a deserved reputation for the cure of *gout and rheumatism*. With the internal use of the waters should be conjoined baths, douches, etc. *Gout* and *rheumatic affections of internal organs* are equally amenable to the same treatment.

These alkaline waters, long used, are especially serviceable in the so-called *lithic-acid diathesis.* There is little doubt that the continuous use of alkaline waters for a long period will cause the solution of *uric-acid renal calculi.* For this purpose those alkaline waters rich in potassa are preferable.

When *diabetes* is hepatic in origin, and occurring in obese subjects, the alkaline mineral waters are extremely useful. A suitable diet should be enjoined.

The following domestic mineral waters may be advised in the above states: Bladon Springs; the California Seltzer; Perry Springs; St. Louis Spring; but especially, Capon Springs.

Of the foreign, the most important are Vichy, which is imported at a moderate price, Mont Dore, Vals, Ems, Salzbrunn, and Gleichenberg.

The psychical influences of change of scene, associations, and climate, are largely concerned in the results of treatment with the waters of mineral springs.

SALINE MINERAL WATERS.

1. North American.

St. Catharine's Wells, St. Catharine's, Ontario, Canada.

These contain chloride of sodium (217 to 275 grains to the pint), chlorides of potassium, magnesium, calcium (108 to 127 grains to the pint), sulphate of lime, and iodide and bromide of magnesium. A concentrated water prepared by evaporation is used, properly diluted by patients at a distance for internal diseases, and at the wells, externally.

These waters are diluted with ordinary water to three-fourths or seven-eighths, before they are drunk. They are chiefly used as warm baths. The diseases in which they have been found most beneficial are *chronic gout*, *rheumatic gout*, *chronic rheumatism*, and *gouty* and *rheumatic diseases*, *strumous diseases*, *engorgement* of the *pelvic viscera*, *chronic metritis*, *uterine fibroids*, *hæmorrhoids*, etc.

Spring Lake Well, Ottawa County, Michigan.

The water of this spring contains chloride of sodium (50.691 grains to the pint), chloride of calcium (14.177 grains to the pint), chloride of magnesium, carbonates of soda, manganese, and iron, in small quantity, sulphate of soda (5.837 grains to the pint), bromide of magnesium, and a trace of lithia.

These waters are applicable to the treatment of *gout*, *rheumatism*, *strumous diseases*, etc. The waters are drunk and used as warm baths.

Saratoga Springs, Saratoga, New York.

In general terms, these waters contain chloride of sodium, the alkaline carbonates, and are highly charged with carbonic-acid gas. The springs are numerous, and differ somewhat in composition. I subjoin a tabular statement of the analyses of the different waters, from the excellent work of Dr. Walton:

One pint contains—	High Rock. 52° Fahr. Prof. C. F. Chandler.	Congress. 52° Fahr. Prof. C. F. Chandler.	Hathorn. Prof. C. F. Chandler.	Empire. Prof. C. F. Chandler.	Columbian. J. H. Steele, M. D.	Pavilion. Prof. C. F. Chandler.	United States. Prof. C. F. Chandler.	Seltzer. 50° Fahr. Prof. C. F. Chandler.
Solids.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.
Carbonate of soda	8.024	0.934	0.872	0.782	1.886	0.827	0.405	2.552
Carbonate of magnesia	4.069	9.019	18.072	8.182	8.461	5.650	5.899	2.988
Carbonate of iron	0.185	0.081	0.101	0.079	0.698	0.283	0.065	0.155
Carbonate of lime	11.443	12.449	14.815	9.520	8.500	10.482	8.084	7.804
Carbonate of lithia	0.154	0.374	....	0.168	....	0.744	0.380	0.071
Carbonate of strontia	trace.	trace.	trace.	trace.	....	trace.	0.001	trace.
Carbonate of baryta	0.050	0.095	0.178	0.008	....	0.090	0.094	trace.
Chloride of potassium	1.122	1.006	1.199	0.586	....	0.958	1.078	0.167
Chloride of sodium	48.766	50.055	68.746	68.828	33.875	57.489	17.784	16.786
Sulphate of potassa	0.201	0.111	trace.	0.346	....	0.254	....	0.009
Sulphate of soda	....	....	....	....	....	....	....	....
Sulphate of magnesia	....	....	....	....	....	....	....	....
Phosphate of soda	trace.	0.002	0.001	0.008	....	0.001	0.002	trace.
Phosphate of lime	....	....	....	....	....	....	....	....
Iodide of sodium	0.011	0.017	0.025	0.001	0.320	0.009	0.006	0.004
Bromide of sodium	0.091	1.069	0.192	0.088	....	0.128	0.106	0.079
Fluoride of calcium	trace.	trace.	trace.	trace.	....	trace.	trace.	trace.
Biborate of soda	trace.	trace.	....	trace.	....	trace.	trace.	trace.
Alumina	0.153	trace.	0.016	0.052	....	0.041	0.012	0.047
Silicate of potassa	....	....	....	....	....	....	....	....
Silicate of soda	....	....	....	....	....	....	....	....
Silica	0.283	0.105	0.157	0.182	0.256	0.394	0.898	0.820
Organic matter	trace.	trace.	trace.	trace.	....	trace.	trace.	trace.
Total	69.502	75.267	98.874	78.215	47.946	76.745	88 764	81.042
Gas.	Cubic in.	Cubic in.	Cubic in.	Cubic in.	Cubic in.	Cubic in.	Cubic in.	Cubic in.
Carbonic acid	51 (1866.)	49 (1871.)	47	43 (1872.)	84	41	80	40

One pint contains—	Geyser. 46° Fahr. Prof. C. F. Chandler.	Star. 52° Fahr. Prof. C. F. Chandler.	Red Spring. Prof. J. H. Appleton.	Eureka. R. L. Allen, M. D.	Excelsior Rock. R. L. Allen, M. D.	Hamilton. R. L. Allen, M. D.	Crystal. 50° Fahr. Prof. C. F. Chandler.
Solids.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.
Carbonate of soda	6.175	1.097	1.107	0.625	1.875	4.281	1.212
Carbonate of magnesia	10.822	4.586	2.618	8.667	4.042	4.833	5.568
Carbonate of iron	0.089	0.110	....	0.875	0.402	0.578	0.185
Carbonate of lime	14.793	10.795	7.824	5.165	9.625	12.249	8.845
Carbonate of lithia	0.549	0.124	0.016	....	....	....	0.899
Carbonate of strontia	0.041	trace.	....	....	....	....	trace.
Carbonate of baryta	0.206	0.010	....	....	....	....	0.074
Chloride of potassium	8.079	1.212	0.686	....	....	....	1.040
Chloride of sodium	70.260	49.795	8.699	20.852	46.880	37.382	42.058
Sulphate of potassa	trace.	0.675	....	....	....	....	0.269
Sulphate of soda	....	....	....	....	0.165	....	....
Sulphate of magnesia	....	....	....	0.268	....	....	....
Phosphate of soda	trace.	trace.	trace.	....	....	....	0.001
Phosphate of lime	....	....	trace.	....	....	....	....
Iodide of sodium	0.081	0.015	....	0.588	0.529	0.449	0.009
Bromide of sodium	0.276	0.071	....	0.196	....	....	0.051
Fluoride of calcium	trace.	trace.	....	....	....	....	trace.
Biborate of soda	trace.	trace.	....	....	....	....	trace
Alumina	trace.	trace.	[1] 0.219	0.029	....	....	0.088
Silicate of potassa	....	....	....	....	0.875	....	....
Silicate of soda	....	....	....	....	0.500	....	....
Silica	0.018	0.160	0.839	0.067	....	[2] 0.125	0.401
Organic matter	trace.	trace.	....	....	....	....	trace.
Total	105.884	68.650	21.008	81.527	64.848	59.897	60.069
Gas.	Cubic in.	Cubic in.	Cubic in.	Cubic in.	Cubic in.	Cubic in.	Cubic in.
Carbonic acid	57 (1870.)	50	....	29	81	40	39 (1870.)

[1] Alumina and sesquioxide of iron.

[2] Silica and alumina.

These waters are useful in *plethora of the abdominal viscera*, in *obesity*, in *habitual constipation* due to deficient secretion, in *plethora of the pelvic viscera*, *hæmorrhoids*, etc. The waters of the Pavilion and Geyser Springs, owing to the quantity of lithia which they contain, are especially serviceable in *chronic gout*, *chronic rheumatism*, *rheumatic gout*, and affections dependent on these diatheses. The Columbian, Pavilion, Eureka, and Excelsior Rock, containing a considerable proportion of iron, are more especially adapted to cases of the abovementioned disorders, in which anæmia exists, but they must be drunk with caution by the plethoric.

Ballston Spa, Ballston, Saratoga County, New York.

These waters are similar in composition to the waters of the Saratoga Springs, but they are richer in mineral constituents. The proportion of chloride of sodium ranges from 53.12 grains to 93.753 grains in a pint. The Lithian Well contains 13.378 grains of carbonate of magnesia, 20.675 grains of carbonate of lime, 4 grains of chloride of potassium, to the pint, besides carbonates of soda, iron, lithia, strontia, baryta, phosphate of soda, sulphates of potassa and soda, iodide and bromide of sodium. Carbonic-acid gas from 30 to 57 cubic inches.

These waters are applicable to the treatment of the same cases as the Saratoga waters.

2. European.

Cheltenham, Gloucestershire, England.

These spas are saline aperient, ioduretted saline, ioduretted-magnesian saline, and the waters contain a good deal of carbonic acid. The season is from July to October. These waters are chiefly serviceable in *dyspepsia*, *hepatic affections*, and *constipation*. Some of the springs at Cheltenham contain iron, and the water of these is employed in *chlorosis* and *anæmia*.

Leamington, Warwickshire, England.

These waters contain chlorides of calcium and sodium, and sulphate of soda, with carbonic acid. They are much prescribed in *dyspepsia*, *acidity*, and *hepatic troubles*, *constipation*, etc.

Adelheidsquelle, Heilbrunn, Bavaria. Altitude 2,000′. Temperature of spring, 50° Fahr. Season, May to September.

This valuable water contains chloride of sodium, carbonate of so dium, iodide and bromide of sodium, etc.; carbonic acid, 13.18 cubic inches. It is highly prized in *strumous diseases*, *rheumatism*, *gout*, *affections of the skin*, and pelvic troubles of females (*chronic metritis*, *fibroids*, etc.).

Baden-Baden. Altitude, 616′. Mean annual temperature, 48° Fahr. Season, May to October.

According to Bunsen's analysis, these waters contain chloride of sodium, bicarbonate of lime, magnesia, and iron, sulphates of lime and potash, arseniate of iron (a trace), chloride of potassium, bromide of sodium (traces), etc.; carbonic-acid gas. The Meurquelle contains 2.3694 grains of chloride of lithium in 20 ounces.

Carlsbad, Bohemia. Altitude, 1,200′. Season, June to September.

These waters contain sulphate of soda, carbonate of soda, chloride of sodium, sulphate of potash, carbonate of lime, etc. Marktbrunnen contains, besides these ingredients, a small quantity of carbonates of lithia, strontia, and manganese, and iodide and bromide of sodium; the gas is carbonic acid.

The Carlsbad water is highly prized in *affections of the liver and portal system, uterine diseases, gout, rheumatism,* and *diabetes.*

Friedrichshall, Saxe-Meiningen, Germany. Bitter water.

According to Liebig, this water contains sulphate of soda 46.51 grains, sulphate of magnesia 39.55, chloride of sodium 61.10, chloride of magnesium 30.25, sulphates of potash 1.52, and of lime 10.34 grains. Carbonic-acid gas, 5.32 cubic inches.

This is *aperient,* and is *used in diseases of the stomach, liver, intestines, and kidneys.* It is imported in quart-bottles, and is much prescribed as a laxative in *habitual constipation,* in *hepatic troubles, plethora of pelvic organs,* etc.

Homburg, Central Germany. Altitude 600′. Open all the year, but the season is from May to September. Temperature, 50° to 53° Fahr.

According to the analysis of Liebig and Hofmann, these waters contain chlorides of sodium (79 to 104 grains), potassium, magnesium, and calcium, carbonates of lime, magnesia and iron, and sulphates of soda and lime. Free carbonic acid, 48 cubic inches.

In therapeutical action they are laxative, and are prescribed in *habitual constipation, dyspepsia, abdominal and pelvic plethora, obesity, hypochondriasis, hysteria,* etc.

Kissingen, Bavaria. Altitude, 800′. Temperature of springs, 50° Fahr. The season is from May to September.

Liebig's analysis has shown that these waters contain chlorides of sodium (17.52 to 44.71 grains), potassium, lithium, and magnesium, sulphates of lime and magnesia, carbonates of lime and iron, bromide and iodide of sodium, etc. They are highly charged with carbonic acid.

Kissingen waters are laxative, and are used in *dyspepsia, hepatic obstructions, albuminuria, diabetes,* etc.

Kreutznach, Rhenish Prussia. Altitude, 285′. Season is from June to September.

This powerfully-alterative water contains chloride of sodium (72 to 108 grains to the pint), chloride of calcium (13 to 22 grains to the pint), chlorides of magnesium, potassium and lithium, carbonate of lime and iron, bromide and iodide of magnesium.

The mother-liquor of Kreutznach contains 2,484 grains of solid matter in sixteen ounces.

These waters are extremely serviceable in *constitutional syphilis, strumous diseases, affections of the skin, rheumatism, gout, engorgement of the abdominal and pelvic organs, hepatic diseases,* etc.

Marienbad, Bohemia. Altitude, 1,900′. Season is from May to September.

The principal constituents of this water are sulphate of soda, bicarbonate of soda, chloride of sodium, bicarbonate of lime, bicarbonate of magnesia, and salts of lithia, strontia, iron, and manganese, in small quantity; carbonic-acid gas.

Laxative, and used in *hepatic disorders, dyspepsia, habitual constipation, gravel, gout,* etc.

Reichenhall, Upper Bavaria. Altitude, 1,407′. Mean temperature of spring, 56° Fahr.; of summer, 64° Fahr.; of autumn, 54° Fahr. Season, July and August.

Used only for baths. Inhalations are practised here on a large scale. "The compressed-air cure" is also used. Scrofula, phthisis, and affections of the throat, are chiefly treated.

The waters are rich in chlorides of sodium and magnesia, and sulphates of soda and lime.

Seidlitz, Bohemia.

The chief constituents are sulphate of magnesia, sulphate of soda, carbonate of lime, sulphate of lime, sulphate of potash, and chloride of magnesium.

Saline purgative.

Selters, Nassau.

Kastner's analysis has shown that this water contains bicarbonate of soda, chloride of sodium, bicarbonates of lime and magnesia, iron and manganese, phosphates of lime, alumina and soda, bromide of sodium, etc. Highly charged with carbonic acid.

Laxative and alterative.

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AMMONIUM AND ITS PREPARATIONS.

PREPARATIONS.—*Ammonii Benzoas.* Benzoate of ammonium. **Benzoic acid and ammonia. In minute, white, shining, thin, four-sided, laminar crystals; bitter, saline, and somewhat balsamic in taste; soluble in water (1 in 5), and in rectified spirit (1 in 12). Dose, gr. v—gr. xv.**

Ammonii Carbonas.—Carbonate of ammonium. In white, translucent masses, with a pungent and ammoniacal odor, soluble in water (1 in 4). Dose, gr. v—gr. x.

Ammonii Chloridum Purificatum.—Purified chloride of ammonium. Sal-ammoniac. In a snow-white, crystalline powder, soluble in two and a half parts of cold water, and sparingly soluble in alcohol (1 in 55). Dose, gr. j—℈j.

Ammonii Valerianas.—Valerianate of ammonium. A white salt in quadrangular plates, having the odor of valerianic acid, and a sharp, sweetish taste, and is very soluble in water and in alcohol. Dose, gr. 1—gr. v.

Ammonii Phosphas.—Phosphate of ammonia. In colorless, transparent prisms, soluble in water (1 in 2), but insoluble in alcohol. Dose, gr. v—℈j.

Aqua Ammoniæ.—Water, or solution, of ammonia. Ammonia-gas dissolved in water. A transparent, colorless liquid, having a very pungent odor. Dose, ʒ j, contains 5.2 grains of ammonia.

Liquor Ammonii Acetatis.—Solution of acetate of ammonium. Spirit of mindererus. Dose, ʒ j—℥ j.

Spiritus Ammoniæ.—Spirit of ammonia. A solution of ammoniacal gas in alcohol. Dose, m. x—ʒ j.

Spiritus Ammoniæ Aromaticus.—Aromatic spirit of ammonia. Solution of carbonate of ammonia, oils of lemon, nutmeg, and lavender, in alcohol and water. Dose, ʒ ss—ʒ ij.

Linimentum Ammoniæ.—Liniment of ammonia. Olive-oil and aqua ammoniæ (℥ j—℥ ij).

Raspail's Eau Sédatif.—Liquor ammoniæ, two ounces; chloride of sodium, two ounces; camphorated spirits of wine, three drachms; water, thirty-two ounces.

Antagonists and Incompatibles.—The vegetable and mineral acids, acidulous salts, earthy salts, and lime-water, are incompatible with the carbonate. In addition to the acids, potash, soda and their carbonates, salts of lead, silver, and metallic sulphates, are incompatible with the solution of the acetate. The persalts of iron, acids, and liquor potassæ, are incompatible with the benzoate. Alkalies, alkaline earths and their carbonates, and lead and silver salts, are incompatible with the muriate. In the treatment of poisoning by ammonia or its carbonate, the vegetable acids should be used to neutralize the poison, and its irritant action on the mucous membrane should be limited as much as possible by the administration of oil and demulcents.

Therapeutically, ammonia is antagonized by veratrum viride, aconite, digitalis, cold, and other cardiac sedatives.

Synergists.—The action of ammonia is favored by heat, opium, iodine, by the antispasmodics, as valerian, asafœtida, etc., by the diffusible and aromatic stimulants, as alcohol, ether, etc. The therapeutical activity of the iodides and bromides is promoted by combination with carbonate of ammonia.

Physiological Action.—Ammoniacal gas, brought in contact with a mucous surface, irritates it; applied to the eye, it reddens the conjunctiva, and causes lachrymation; applied to the nares, it reddens the mucous membrane, produces a sense of heat and burning, and increases the secretion of mucus. Inhaled, an overpowering sense of suffocation is experienced, and the glottis spasmodically closes. Prolonged contact with the air-passages excites violent inflammation. When solution of ammonia is swallowed, an active and destructive inflammation of the mucous membrane is set up; the lips, tongue, soft palate, and tonsils, are swollen, red, and glazed; the epiglottis, and especially the arytæno-epiglottidean folds, becomes œdematous, and sudden death may ensue from œdema of the glottis. Inflammation of the œsophagus, and of a limited portion of the stomach, will also follow the introduction of any portion of the irritant. Narrowing (stenosis) of the pyloric orifice has been noted, in one case, as an after-result of the inflammation set up in this part. In the stomach, ammonia and its carbonate must quickly combine with the acid, and probably enter the blood in such combination. Increased action of the heart is produced by its administration by the stomach, but much more decidedly when it is thrown directly into a vein. After the intra-venous injection of ammonia, the blood-pressure at first rises, then falls below the normal. Resulting, doubtless, from the increased action of the heart, and the more rapid circulation of the blood, a subjective sensation of warmth throughout the body is experienced, the face becomes flushed, the eyes are more brilliant, and the mental operations increase in activity. Little is known of the behavior of ammonia in the blood, which in the normal state contains this gas. Although it is now known that the coagulation of the blood is not caused by the escape of ammonia, as supposed at one time by Richardson, yet ammonia helps to maintain the fluidity of the blood, as its presence, in sufficient quantity, certainly serves to hold the fibrine in solution.

The long-continued use of ammonia impairs digestion, by neutralizing the gastric juice. Increased waste of tissue is also one result of its administration, manifested by pallor, emaciation, and feebleness. When introduced into the blood in sufficient quantity, it damages the structure of the red blood-globules, and in this way also it affects the nutrition of the body, beside the action which it has, in common with the other alkalies, of increasing the rate of waste or retrograde metamorphosis.

The summary of the physiological actions of ammonia, above given, pretty fairly represents the movement of these agents as a group; but individual differences undoubtedly exist, which will be pointed out when the therapy is considered.

Therapy.—Ammonia and its carbonate are sometimes used to diminish *acidity* of the stomach-juices. *Obstinate vomiting*, after irritating substances are removed, and when the vomited matters are acid, may be relieved by the use of the carbonate, or better, by an excess of carbonate in solution of the acetate. The *acidity*, *gaseous eructations*, and *abdominal distention*, which accompany attacks of hysteria in some females, may be quickly removed by the aromatic spirit of ammonia. *Nervous headache*, especially when it is present with the last-mentioned group of symptoms, is speedily relieved by the aromatic spirits and the carbonate; but true *migraine*, although these preparations of ammonia may palliate it, is generally more certainly relieved by the bromides. Raspail's *eau sédatif* often gives great comfort in headache, when locally applied.

In *gastric* and *intestinal catarrh*, chloride of ammonium is held in high repute by our German *confrères*. It is certainly highly serviceable in some *hepatic disorders*—for example, in *catarrh of the bile-ducts* and in the *jaundice* arising from this cause. In the first stage of *cirrhosis*, before contraction and induration have occurred, it is also useful. The nauseous saline taste of the sal-ammoniac is best covered by fluid extract of taraxacum or extract of liquorice. The fluid extract of taraxacum is to be preferred as the vehicle in hepatic disorders, because this drug has reputed virtues in these cases. When there is *deficiency of secretion of the intestinal juices*, *constipation*, and a *coated tongue*, with *scanty and high-colored urine* (so-called bilious state), sal-ammoniac is one of the remedies which may be used with success. That this drug has a selective action on the liver seems probable from the fact that it increases the excretion of urea by the kidneys.

To *stimulate the action of the heart* when it flags, the ammonia preparations have an undoubted effect; hence in adynamic states they are frequently used. When employed for this purpose, small doses frequently repeated (every half-hour or hour) are necessary, owing to the fact that ammonia is quickly eliminated. It is a most common practice to inhale ammonia to prevent that depression of the heart's action called *fainting*. It should not be forgotten that ammonia, incautiously inhaled, may give rise to inflammation of the fauces and glottis. The preparations of ammonia (spirits, carbonate, water of) possess a high degree of utility when *thrombosis* is actually existent, but especially when threatened, as in the *puerperal state*, after *free hæmorrhage*, when the circulation is languid from weak heart, a state of hyperinosis being present. It is perfectly safe and legitimate under these circumstances to practice the intra-venous injection of aqua ammonia, ʒ j—ʒ ij, diluted with an equal measure of water. This practice seems more particularly advisable when sudden thrombosis of a large venous trunk ensues—as, for example, in the pulmonary artery, after uterine hæmorrhage. In sudden *paralysis of the heart from chloroform narcosis*, *the bite of venomous snakes*, etc., this practice has been resorted to, but hitherto, without any recognized success. As regards the intra-venous injection of ammonia as a remedy for the bite of venomous snakes, Brunton and Fayrer have shown that this practice is without avail. Ammonia is a *physiological antagonist to hydrocyanic acid*, and is used in poisoning by this agent; it counterbalances the depression, and maintains the heart's action, until the effects of the poison are spent.

Carbonate of ammonia is one of the remedies occasionally successful in the treatment of *delirium tremens*. It is indicated, and proves most serviceable, when there is present anæmia of the brain, and the heart's action is feeble. Half-ounce doses of solution of ammonia acetate are said to remove the effects of alcoholic intoxication. The *valerianate of ammonia* and the aromatic spirits of ammonia abort or prevent paroxysms of *hysteria*. *Nervous headache* and also *migraine* may sometimes be cured by the various preparations of ammonia; but of these the muriate is exceptionally serviceable. Indeed, Dr. Anstie affirms that this agent, if given early enough, seldom fails to cut short an attack of *migraine*. It should be administered in doses of from ten to twenty grains. In *myalgia* or muscular neuralgia, it is equally effective according to the same authority: ℞. Ammonii muriat., ℥ j; ext. cimicifugæ, fl ℥ ij; syrup. simplicis, aquæ laur. cerasi, āā ℥ j. M. Sig. A teaspoonful three or four times a day. In other neuralgiæ the muriate of ammonia is occasionally useful, but by no means so curative as in *migraine* and myalgia.

The preparations of ammonia are classed with the *stimulant expectorants*. It is an interesting fact, in this connection, that they are eliminated largely by the lungs; and it is probable, indeed, that in thus escaping they stimulate secretion and liquefy the products of inflammation. In *bronchorrhœa* and *chronic bronchitis*, muriate of ammonia renders important service. It is given in extemporaneous prescriptions with extract of liquorice, and may be combined with other stimulating expectorants when no incompatibility exists: ℞. Ext. eucalypt., fl ℥ j; ammonia muriat., ʒ ij; ext. glycyrrhiza, ʒ ij; syrup. tolu., ℥ iij. M. Sig. A teaspoonful four or six times a day. When great depression exists in *pneumonia*, carbonate of ammonia is given with advantage. It should be remembered that to stimulate the heart merely, when an obstacle exists in the pulmonary circulation, is of doubtful utility. Ammonia is most useful to counteract the depression which occurs at the period of crisis in *pneumonia*. Given at this time, it favors the liquefaction and excretion of the products of inflammation. When there is much adynamia in these various pulmonary inflammations, the carbonate of ammonia is frequently prescribed in infusion of senega, a stimulating expectorant.

Extraordinary success has been claimed for carbonate of ammonia in *variola*, *scarlatina*, *rubeola*, and *erysipelas*. A convenient mode of administration is to dissolve the carbonate in the solution of the acetate. The indications for the use of the carbonate are, feeble circulation, cyanosis, delirium. As these are self-limited diseases, the mild cases do quite as well without drugs.

Carbonate and acetate of ammonia are much prescribed in *continued fevers*—the latter as a so-called febrifuge; the former when decided adynamia ensues. In *typhoid* the diarrhœa may be increased by the solution of the acetate. As in typhus and typhoid the ammonia in the blood is increased above the normal, it has seemed to the author improper practice to administer ammonia as a remedy in these diseases, and his observations have convinced him that it has no good effects which cannot be better procured by other means.

The muriate of ammonia is said to be an excellent *emmenagogue* in from ten to twenty grains.

Local Uses of Ammonia.—Ammoniacal gas, cautiously inhaled, sometimes gives relief in *acute catarrh*, and in *hay-asthma.* Its good effects are limited, however, to that stadium of these maladies in which the morbid action is confined to the nasal passages, and the discharge is yet serous rather than purulent. The pain and smarting which attend the *stings of insects* are alleviated by the application of diluted aqua ammoniæ. The strong aqua ammoniæ should be at once applied to the *bite of venomous serpents, and of rabid animals.*

Ammonia is frequently employed as a *counter-irritant* in the form of the well-known volatile liniment. As a *vesicant* it is also used when a prompt action is desired, but it is rather uncertain.

A solution of sal-ammoniac in alcohol and water is an excellent discutient application in *inflammatory swellings*: ℞. Ammonii muriat., ʒij; spts. vini rectif., aquæ, āā ℥ij. M. Sig. Lotion. Cloths moistened with the solution can be frequently applied, and the cases in which it is applicable are the following: *Orchitis, inflamed joints, sprains,* and *local* and *external inflammations* generally.

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VEGETABLE ACIDS.

Acidum Aceticum.—Acetic acid. Liquid; specific gravity 1.047. Colorless, having a pungent and characteristic odor. Of this acid one hundred grains neutralize sixty grains of bicarbonate of potassium.

Acidum Aceticum Dilutum.—Dilute acetic acid. One part of the acid to seven parts of water.

Acetum.—Vinegar. Impure dilute acetic acid, prepared by fermentation.

Acidum Citricum.—Citric acid. In colorless crystals, freely soluble in water and soluble in alcohol. One hundred grains of citric acid neutralize one hundred and fifty grains of carbonate of potassium.

Acidum Tartaricum.—Tartaric acid. In colorless crystals, wholly or almost wholly dissipated by heat, and readily soluble in water. One hundred grains of tartaric acid saturate one hundred and thirty-three and a half grains of bicarbonate of potassium.

ANTAGONISTS AND INCOMPATIBLES.—The alkalies are the chemical antagonists; yet, from the physiological point of view, the ultimate results of their action place them in the same division of remedial agents. Therapeutically, the acids are antagonized by those agents which promote constructive metamorphosis.

SYNERGISTS.—The alkalies and agents promoting waste favor the therapeutical actions of the vegetable acids.

PHYSIOLOGICAL ACTIONS.—The vegetable acids, undiluted, have a sharp, pungent, and rather acrid taste; but, when considerably diluted, they are rather agreeable and refreshing. They have the property to diminish the sense of thirst, to abate heat and the restlessness of fever. In large quantity, they possess considerable caustic power, producing gastro-enteritis and the systemic symptoms belonging thereto. These systemic symptoms, especially the slowing of the heart, have been incorrectly, the author thinks, attributed to a special power of these agents to affect the action of the heart.

There can be no doubt that these acids obey the chemical laws of combination, and unite with alkalies to form salts, in which form they enter the blood. The most important question connected with the physiological action of these agents is, the disposition of them in the blood. The most recent and elaborate examination of this point is the "Memoir" of Friedrich Walter. This research appears to have determined that these acids do not have the power to neutralize the alkalinity of the blood, as has heretofore been supposed. That they are in part destroyed in the organism by the ozonizing action of the blood, seems undoubted. Carbonic acid is one of the products, and the presence of this, we may assume, accounts for the increased acidity of the blood and of the urine, which follows the administration of these agents.

They are eliminated by the intestinal canal, and chiefly by the kidneys. They increase secretion from the intestinal mucous membrane, and are apt to produce tormina, flatulence, and diarrhœa. It is probable that these intestinal effects are in part due to the fact that the salts, formed by combination of the acids in the canal, escape absorption and act locally as they descend.

These acids, or the salts formed by their combination, have a decided power to promote diuresis. In this result all of the urinary constituents are included; but it is chiefly the water which is increased. To these general statements some exceptions must be made. Thus, citric and acetic acids are entirely destroyed in their passage through the organism; benzoic acid is converted into hippuric; and tartaric, citric, and malic, are converted into carbonic after combination with alkali only. Furthermore, benzoic acid does not increase any of the urinary constituents.

Ultimately, wasting and emaciation, a watery condition of the blood, a scorbutic state, indeed (Bence Jones), are the results of the action of these agents.

THERAPY.—Acetic acid applied to the skin has some superficial caustic property. This is made use of to cure *small warts* and *vegetations of the skin.* It is applied with a pine stick. *Parasitic affections* of the skin are similarly treated, as, for example, *pityriasis.*

Internally the acids, chiefly citric, in the form of lemonade, are used as a refreshing drink in *fevers.* They allay restlessness by relieving thirst, and they also act upon the skin and kidneys. Lime-juice is the most important *antiscorbutic*, and constitutes part of the equipment of every vessel on long voyages. It should not be forgotten that the use of lemon-juice may cause precipitation of uric acid, and thus favor the formation of calculi, as has been pointed out by Bence Jones.

Lemon-juice was at one time the fashion in the treatment of *acute rheumatism;* but more efficient remedies have taken its place.

Acids are serviceable in various disorders of the digestive tract; given before meals, they check the formation of acid, and thus relieve *acidity.* An acid and dry wine—as, for example, a Rhenish wine—may sometimes serve a useful purpose. The juice of a lemon may be taken before meals with the same object. But it is true that the mineral acids are to be preferred for this purpose. Very injurious effects are produced by the long-continued use of lemon-juice in such cases. It is sometimes taken by young ladies to keep down the formation of fat; but it accomplishes this object by impairing digestion.

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SULPHUROUS ACID AND THE SULPHITES.

Acidum Sulphurosum.—Sulphurous acid. A colorless liquid having the odor of burning sulphur, and a sulphurous, sour, and somewhat astringent taste. Dose, m. v—ʒ j.

Sodii Hyposulphis.—Hyposulphite of sodium. In large, colorless, transparent crystals, having a bitter, slightly alkaline, and sulphurous taste. It is soluble in one and a half part of water at 60°, and insoluble in alcohol. Dose, grs. v—℈ j.

Sodii Sulphis.—Sulphite of sodium. In white, efflorescent prismatic crystals, soluble in four parts of cold, and in less than one part of boiling water. It has a sulphurous taste, and a feeble alkaline reaction. Dose, grs. v—℈ j.

Potassii Sulphis.—Sulphite of potassium. In white, opaque fragments or powder, very soluble in water. It has a saline and sulphurous taste. Dose, grs. iij—grs. x.

Antagonists and Incompatibles.—The mineral acids—including sulphuric—decompose the sulphites and hyposulphites. All oxidizing substances are incompatible. These preparations have a great affinity for oxygen, and the sulphites readily become sulphates.

Synergists.—All remedial agents which arrest fermentative processes promote the therapeutical activity of sulphurous acid and the sulphites.

Physiological Actions.—Sulphurous acid is a disinfectant and deodorizer. It attacks organic matter with energy, by virtue of its affinity for oxygen. It is very destructive to the lower forms of life, bacteria, fungi, etc. Sulphurous-acid gas inspired produces great irritation of the glottis, and an intensely suffocative feeling. In sufficient quantity it produces violent inflammation of the air-passages. As by combination with oxygen sulphuric acid is formed, the destructive effect ascribed to sulphurous acid is in reality chiefly due to sulphuric.

The sulphites exposed to the air rapidly absorb oxygen, and pass to the state of sulphates. The hyposulphites are more constant than the sulphites. In the stomach, by the acid of the gastric juice, these salts are in part decomposed and sulphurous acid is given off; in part they are converted into sulphates. They are undoubtedly absorbed as sulphates, and are eliminated partly by the intestinal canal, but chiefly by the kidneys, as sulphates. The author demonstrated these facts, soon after the publications of Dr. Polli led to an enthusiastic administration of these remedies in the zymotic diseases.

Therapy.—Dilute sulphurous acid is one of the numerous local applications considered efficacious in *mercurial stomatitis*, *aphthæ*, *mucous patches*, *ulcers of the tonsils*, and in *diphtheria*. In all of these affections the diluted acid may be applied directly to the diseased surface by a mop, a sponge-probang, or in the form of spray. A more easily-managed application is a solution of the sulphite of soda (ʒj—℥j) in water. Sulphurous-acid spray is a good local application in *syphilitic* and *tuberculous laryngitis.* Cases of *chronic bronchitis,* with profuse expectoration of a fetid character (bronchorrhœa), are sometimes improved by inhalations of sulphurous-acid gas, or of the acid in the form of spray. Notwithstanding the confident assertions of Dewar, there is no reason to suppose that sulphurous-acid-gas inhalations can modify in any way the progress of *phthisis.*

In certain kinds of *vomiting* of a yeast-like material, especially when *sarcina* are present in the vomited matters, the sulphites are often curative. Vomiting of *acid matters*, *pyrosis*, and *indigestion*, due to *acid fermentation* of the starchy and saccharine elements of the food, are relieved by sulphurous acid (m. v—ʒj, well diluted), or, but less efficiently, by sulphite of soda (℈j—ʒj). The result in these cases is, no doubt, due to the power which sulphurous acid has of arresting fermentation processes.

After the publications of Dr. Polli, of Milan, extravagant expectations were entertained of the curative power of the sulphites in the *zymotic diseases* generally, and in all the various forms of *septic diseases.* Unfortunately, these expectations have not been realized, and the sulphites are no longer employed with this view in any of these disorders; and, as Braun and Bernatzik have shown, they are not only nauseous in taste but they produce more or less irritation of the intestinal canal, and do not in any case modify the course of the disease.

Externally applied, sulphurous acid and the hyposulphites and sulphites are in some maladies extremely serviceable.

As a *disinfectant* and *deodorizer* sulphurous acid is at the same time efficient, easily managed, and economical. Sulphurous acid is the product of the combustion of sulphur in the open air; hence, to disinfect rooms, it is necessary only to close all egress and fill them with the fumes of burning sulphur. It is to be remembered that sulphurous acid is injurious to many fabrics: the sulphites are colorless and soluble.

Sulphurous acid is an efficient application to *chilblains:* ℞. Acid. sulphurosi, ʒ iij; glycerini, ʒ j; aquæ, ʒ j. M. In *parasitic skin-diseases*, the sulphites, hyposulphites, and sulphurous acid, are used to destroy the parasites. The following formula is employed by Startin in these affections: ℞. Sodii hyposulphitis, ℥ iij; acid. sulphurosi dil., ℥ss; aquæ q. s. ad ℥xvi. Fox recommends the following formula in *tinea versicolor* and in *pruritus vulvæ:* ℞. Sodii hyposulphitis, ʒ iv; glycerini, ʒ ij; aquæ destil. ad ℥ vi.

Sulphurous acid is an excellent application to *ill-continued, sloughing*, or *gangrenous wounds.* It was found to be very successful in these cases, at the English hospital at Metz, during the Franco-German War

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Sulphides (Sulphurets).—*Potassii Sulphuretum.* Sulphide of potassium has a brownish-yellow color when freshly broken. It dissolves in water, with the exception of a slight residue, and forms an orange-yellow solution, which exhales the odor of hydrosulphuric acid. Dose, gr. j—gr. v.

Calcii Sulphuretum.—Sulphide of calcium. Unofficinal. A greenish-gray paste, having a strong odor of sulphuretted hydrogen. Dose, gr. j—gr. v.

Antagonists and Incompatibles.—Solutions of the sulphides are decomposed by the mineral acids, sulphuretted hydrogen being liberated and sulphur precipitated. Solutions of the metals, generally, are also incompatible with the sulphides of potassium and calcium, for, in the decomposition which ensues, the metals are precipitated in the form of insoluble sulphides. Hence it is that these preparations have been proposed as antidotes to the metallic poisons. Chlorine-water, chlorides of sodium and potassium, sulphate of iron, etc., are chemical antidotes.

Synergists.—All agents promoting waste are, therapeutically considered, synergistic. Alkalies favor their action, both chemically and physiologically.

Physiological Actions.—These preparations have a decidedly nauseous taste and smell, and are somewhat irritant. In the stomach they excite a sense of heat, and in sufficient quantity cause gastro-enteritis, with all the attendant symptoms belonging to irrritant poisons. Disagreeable eructations of sulphuretted hydrogen take place when they are administered medicinally, owing to the reactions in the presence of an acid alluded to above. They increase secretion from the gastro-intestinal canal, and are laxative. The fetor of the stools is increased by their use, a result not altogether due to the evolved sulphuretted hydrogen, but to the increased action of those intestinal glands concerned in elimination. As the sulphides pass easily to the state of sulphates by the action of oxygen, it may be assumed that a part of their physiological effects is produced by the latter salts. They, however, undoubtedly exercise a toxic action on the blood, impairing the red blood-globules, and increasing the amount of effete material. Emaciation muscular weakness, and trembling, and a feeble circulation, are results of their use in large amount, or for lengthened periods. It is true that some acceleration of the pulse-rate and increase of secretion of the mucous surfaces follow their medicinal administration for a short period and in moderate doses; but the prolonged inhalation of sulphuretted hydrogen, or the prolonged internal use of the sulphides, causes great anæmia, wasting, and debility.

THERAPY.—Although the sulphides are indicated as remedies when the secretions of the intestinal glandular appendages are deficient, they are too disagreeable to be prescribed under ordinary circumstances. The water of the well-known Blue Lick Spring, of Kentucky, which is almost identical in composition with the famous Harrogate, of England, may be substituted for the sulphides in many of the cases in which the latter are useful.

The Blue Lick water, like the Harrogate, is useful in *abdominal plethora.* A pint taken before breakfast is an *efficient laxative*, which is indicated in cases of habitual constipation from deficient secretion of the intestinal juices. Four ounces taken before each meal is an excellent remedy for *obesity. Engorgement of the pelvic viscera* in women, *hæmorrhoids* in both sexes, when due to torpor of the portal circulation, are relieved by the same agent. For these purposes the Blue Lick water may be taken for several weeks or even months, but its use should be discontinued when anæmia is threatened. In anæmic subjects, chalybeates and a generous diet should be conjointly administered. The author has observed excellent results from the prolonged use of this water in *glandular affections, hepatic, splenic, uterine, and of the prostate.*

A succession of *common boils, scrofulous and other abscesses*, are, it is said, made to mature, and the expulsion of the pus is favored by the use of the sulphides. When abscesses are threatened, and before matter has formed, the sulphides, it is claimed, may cause them to abort. Small doses (gr. ss—gr. j) frequently repeated (every hour or two) are said to be most effective under these circumstances.

EXTERNAL USES OF THE SULPHIDES.—A solution of the sulphide of potassium (ʒ ss—℥ j) is an efficient application in *scabies.* An extemporaneous sulphide may be made by boiling one part of quicklime and two parts of sublimed sulphur in ten parts of water. With this solution the parts affected by scabies may be painted over, after preliminary cleansing with a warm bath. Sulphur-baths (solution of sulphide of potassium in water, as above mentioned) are very excellent applications in the *chronic* forms of *psoriasis* and *eczema.* The following formula is recommended by Fox in *scabies* and *prurigo*: ℞. Potassii sulphureti, ℥ vi; sapon. alb., ℔ij; ol. olivæ, Oij; ol. thymi, ʒ ij. M. A milder preparation is the following: ℞. Potassii sulphureti, ʒ iij; sapon. moll., ℥ j, aquæ calcis, ℥ viij; alcohol, ℥ ij. M. Or the following: ℞. Potassii sulphureti, ℥ ss; aquæ calcis, ℥ xvj. M. For the relief of *pityriasis* and *parasitic skin-diseases.*

The sulphide of sodium (unofficinal) being more stable, is better suited for the preparation of sulphurous baths. An artificial sulphurous water, in imitation of the *Barèges*, is made as follows: ℞. Sulphidi sodii, sodæ, sodii chloridi, āā ℥ ij. M. Sig. A sufficient quantity for one bath. The *Pommade de Barèges* of the French is constituted as follows: ℞. Sodii sulphureti, sodii carbonat., āā ʒ ij; axungiæ, ℥ ijss. M.

Sulphur-baths are frequently employed to favor the elimination of lead, in cases of *saturnine disease.* For this purpose, from three to five drachms of sulphide of potassium may be dissolved in sufficient water for a bath. A sulphide of lead is formed on the skin; but that the sulphur-bath promotes the elimination of lead by the sweat-glands more than a simple warm bath, seems hardly credible.

The disagreeable odor of the sulphides, in ointment or solution, may, it is said, be much modified by the addition of a little oil of aniseseed.

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SULPHUROUS MINERAL WATERS.

1. NORTH AMERICA.

French-Lick Springs.

West-Baden Springs, Orange County, Indiana.

Indian Springs, Martin County, Indiana.

These waters contain carbonates of soda, potassa, magnesia, and lime, and chlorides of sodium, potassium, magnesium, and calcium, and sulphates of soda, magnesia, lime, and potassa. The gases are sulphuretted hydrogen and carbonic-acid gas.

Upper Blue-Lick Springs, Nicholas County, Kentucky.

Lower Blue-Lick Springs, Nicholas County, Kentucky.

Big-Bone Springs, Boone County, Kentucky.

Paroquet Springs, Bullitt County, Kentucky.

These waters are remarkable for the quantity of sulphuretted hydrogen which they contain (from 1.02 cubic inch to 3.75). They are rich in the chloride of sodium (from 38.700 grains to the pint to 64.567 grains). They contain also chlorides of potassium, sodium, magnesium and calcium, carbonates of soda, magnesia, iron, and lime, sulphates of soda, potassa, and magnesia, and appreciable quantities of iodides and bromides.

Alpena Well, Alpena County, Michigan.

This water contains the large quantity of 4.42 cubic inches of sulphuretted hydrogen to the pint. The proportion of chloride of sodium is small (8.532 grains to the pint). The other ingredients are carbonates of soda, magnesia, iron, and lime, and sulphate of lime.

Sharon Springs, Schoharie County, New York.

Avon Springs, Livingston County, New York.

Mild sulphuretted waters. The principal salt is sulphate of lime, which is found in the different springs, ranging from 11.687 grains to 13.95 grains to the pint (Sharon).

Yellow-Sulphur Springs, Montgomery County, Virginia.

The most important constituents of these waters are sulphates of lime, magnesia, soda, potassa, and alumina, and carbonates of lime, magnesia, and iron. The gas is carbonic acid and sulphuretted hydrogen.

Greenbrier White-Sulphur Springs, Greenbrier County, Virginia.

Salt-Sulphur Springs, Monroe County, West Virginia.

Red-Sulphur Springs, Monroe County, West Virginia.

These springs are nearly alike as respects the composition of their waters. They contain chlorides and sulphates, but their principal constituents are sulphate of lime, sulphate of soda, and sulphate of magnesia. The Greenbrier Spring and the Red-Sulphur Spring waters contain also a peculiar sulphur compound, in regard to the nature of which but little is known.

2. EUROPEAN.

Harrogate, Yorkshire, England. Season from May to September.

These waters contain chlorides of calcium, magnesium, potassium, and sodium, carbonic-acid gas, and sulphuretted hydrogen.

Llandrindod, Wales.

Saline, chalybeate, and sulphur waters; rich in chlorides, especially of sodium.

Strathpeffer, Ross-shire, Scotland.

This is a strong sulphuretted water, and contains sulphate of lime, carbonate of lime, sulphate of magnesia, and sulphate of soda.

Moffatt, south of Scotland.

The waters contain chloride of sodium (28.07), sulphate of soda, sulphate of lime, and sulphuretted-hydrogen gas.

Bareges, Hautes-Pyrénées. Altitude, 4,000′. Temperature, 86° to 113° Fahr. Season from July to September.

Waters contain sulphide of sodium, sulphate of soda, chloride of sodium, etc.

These waters are used chiefly for bathing the patients, beginning with the colder and passing on to the hotter waters. These springs have a special celebrity for the treatment of old wounds, diseases of bones, and rheumatic and neuralgic affections.

Cauterets, Hautes-Pyrénées. Altitude, 3,000′, but sheltered. Season, June to September. Temperature of baths, 98° to 131° Fahr.

The composition of the waters is similar to that of those of Baréges, but it is more stimulating, and contains a good deal of iodine. It is especially advised in incipient tuberculosis, bronchial affections, and pelvic diseases of women.

Eaux-Bonnes, Basse-Pyrénées, near Pau. Altitude, 2,000′.

Waters sulphurous and saline, similar to but not so exciting as those of Baréges. This resort is celebrated chiefly for its effects in laryngeal diseases and clergyman's sore-throat.

Challes, Savoy.

This water, according to Macpherson, is one of the most remarkable in Europe, and "is the strongest sulphur-well known." It contains iodine and bromine, sulphide of sodium, bromide of sodium, etc.

Aix-la-Chapelle, Rhenish Prussia. Altitude, 450′. Temperature of air during season, mean, 63° Fahr. Season from June to September.

According to Liebig's analysis, these waters contain chloride of sodium (20 grains), bromide, iodide, and sulphate of sodium, carbonate of soda (4.9 grains), sulphate of soda (2.1 grains), sulphate of potash (1.1 grain), and carbonates of lime, magnesia, strontia, lithia, etc. Used by drinking and bathing, and especially in cutaneous diseases, rheumatism, syphilis, hepatic disorders, etc.

Eilsen, Lippe-Schomburg, Northern Germany.

Neundorf, Prussian Westphalia.

These waters contain the sulphates of soda, magnesia, lime, and chlorides of calcium and magnesium. They are highly charged with carbonic-acid gas and sulphuretted hydrogen. They are useful in gouty and rheumatic affections, syphilis, skin-diseases, etc.

Schintznach, Switzerland. Altitude, 1,060′.

This is a highly-sulphurous water, and is charged with carbonic-acid gas and sulphuretted hydrogen. It contains sulphate of soda (9.87 grains), sulphates of potash and lime, chlorides of potassium and magnesium, and carbonates, etc.

Weilbach, Nassau. Altitude, 420′.

These waters contain bicarbonates of soda (3.123 grains), of lithia, of baryta, and of strontia, chlorides of sodium and potassium, carbonates of lime and magnesia, etc. The gases are carbonic acid and sulphuretted hydrogen.

THERAPY OF THE SULPHUR-WATERS.—These waters, as a rule, are useful in *liver-disorders;* they diminish *abdominal plethora*, and *congestion* of the *portal circulation.* They are indicated in *malarial affections of the liver and spleen. Rheumatism and gout, tuberculosis in its incipiency, chronic poisoning by the metals*, etc., are certainly benefited by the internal use, and by baths of sulphurous waters. *Affections of the skin, syphilitic diseases, chronic rheumatic affections*, etc., are especially forms of disease remediable by these waters, used internally and in the form of baths.

Authorities referred to:

Braun, Dr. Julius. *Systematisches Lehrbuch der Balneotherapie.*
Macpherson, Dr. John. *Baths and Wells of Europe.*
Moorman, Dr. J. J. *Mineral Springs of North America.*
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IODINE AND ITS PREPARATIONS.

Iodine.—*Iode*, Fr.; *Iod*, Ger.; *iodinium*, Latin, U. S. P.

Iodinium.—Iodine. In bluish-black crystalline scales, having a metallic lustre; very slightly soluble in water (1 in 7,000); soluble in alcohol (1 in 12), in ether, in a solution of iodide of potassium, and in a solution of chloride of sodium. Dose, gr. ss—gr. j.

Iodoformum.—Iodoform. In yellow crystals, having a saffron-odor. Insoluble in water, but soluble in ether, and the fixed and volatile oils. May be prescribed in a mixture, containing at least twenty times its weight of mucilage to render it properly miscible with water. Dose, gr. j—grs. v.

Liquor Iodinii Compositus.—Compound solution of iodine. Iodine, 360 grains; iodide of potassium, ℥ jss; distilled water, Oj. Dose, m. v.—m. xx.

Tinctura Iodinii.—Tincture of iodine. Iodine, ℥ j; alcohol, Oj. Dose, m. j—m. v.

Tinctura Iodinii Composita.—Compound tincture of iodine. Iodine, ℥ ss; iodide of potassium, ℥ j; alcohol, Oj. Dose, m. ij—m. x.

Unguentum Iodinii.—Ointment of iodine. Iodine, ℈ j; iodide of potassium, grs. iv; water, m. vj; lard, ℥ j.

Unguentum Iodinii Compositum.—Compound ointment of iodine. Iodine, grs. xv; iodide of potassium, ʒ ss; water, m. xxx; lard, ℥ j.

Ammonii Iodidum.—Iodide of ammonium. A white, granular, very deliquescent salt, becoming yellowish-brown by exposure. Very soluble in water and in alcohol. Dose, grs. ij—grs. x.

Potassii Iodidum.—Iodide of potassium. In white or transparent crystals, wholly soluble in water (4 in 3), and in alcohol (1 in 6). Dose, grs. v—ʒ j.

Antagonists and Incompatibles.—Iodine is incompatible with the mineral acids, the metallic salts, the vegetable alkaloids, etc. The chemical antidote is starch, or substances containing it, as flour. These should be given freely diffused in water. It should be remembered that starch is the antidote to free iodine. As, however, the *iodide of starch* is not devoid of activity, in cases of poisoning by iodine, the contents of the stomach should be evacuated. It is obvious that the preparations of iodine, taken after a meal consisting of amylaceous materials, will have their activity impaired by the formation of the iodide of starch, the acid of the stomach freeing the iodine from its chemical association.

Therapeutically, iodine and the iodides are antagonized by all those remedies which promote constructive metamorphosis, and by the vaso-motor tonics, quinine, digitalis, cold, etc.

SYNERGISTS.—Alkalies, and other remedies which increase waste, favor the action of iodine and the iodides. Under some circumstances, mercurials are especially synergistic.

PHYSIOLOGICAL ACTIONS.—*Iodine.*—When brought into contact with albuminous substances, iodine combines with it and prevents putrefactive change. The vapor of iodine, like chlorine, but in a feebler degree, decomposes sulphuretted and phosphuretted compounds. It is, therefore, justly ranked among the disinfectants.

Applied to the skin or mucous membrane, iodine, according to the extent of the application, is irritant or caustic. It stains the skin yellow, causes a sensation of warmth in small quantity, or of burning in larger quantity, and excites a superficial inflammation followed by desquamation. In some subjects the application of iodine-paint causes vesication. Pure iodine, kept in contact with the tissues, produces a brown and dry eschar. The vapor of iodine is very irritant to the broncho-pulmonary mucous membrane, causing cough, spasm of the glottis, and increased flow of mucus.

Iodine has a hot, pungent flavor, and excites a sensation of heat or burning in the stomach. In sufficient quantity, it acts as an irritant poison, inflames the mucous membrane of the stomach, and causes superficial eschars. The amount of iodine necessary to produce toxic symptoms varies greatly, and the variation depends in part on constitutional peculiarities, but chiefly on the amount and quality of the food in the stomach. Whether applied to the surface of the skin or taken into the stomach, it quickly diffuses into the blood, and enters into combination with sodium or potassium, or with both.

Iodides.—The iodides are among the most diffusible substances. They have a bitter, saline, and very disagreeable taste. In a few minutes after being swallowed, the taste of iodide of potassium returns in the mouth, and, during a course of this salt, the saliva is constantly charged with it. In the stomach, in considerable doses, they produce first a cooling sensation, followed by warmth, and even burning. They pass into the blood with great rapidity. It is said that the base is changed in the blood, and the iodides of ammonium and potassium become iodide of sodium. In the blood they probably undergo no further changes, and do not, so far as is known, modify the composition of that fluid. At the points of elimination from the free mucous surfaces (nasal, faucial, and bronchial mucous membrane), the chemical changes which ensue set free ozone, and the irritation there experienced is probably in part due to the iodine, separated from its combinations by the action of that agent (Buchheim). Elimination doubtless takes place by the broncho-pulmonary, faucial, and salivary glands, but chiefly by the kidneys. The diffusion of the iodides into and out of the blood takes place with such rapidity that in fifteen minutes they may be detected in the saliva and in the urine.

Diverse opinions have been expressed in regard to the influence of the iodides over the assimilative functions. By the syphilographers it is held that the iodides promote constructive metamorphosis, and that a gain in body-weight is a result of their use. This opinion is developed in this way: The subjects of syphilis in its constitutional form emaciate, and their forces are depressed; but, when the iodides are given them, the virus is eliminated, and the organism at once reacts. In the physiological state the iodides increase waste and the elimination of the products of waste, and emaciation with a general depression of the vital functions ensues, when they are administered for lengthened periods.

Iodism.—Iodine and the iodides, when given in large quantity, produce a state termed *iodism.* The quantity which will set up this state of irritation in one subject will affect another but slightly, if at all; in other words, the susceptibility to the iodine impression varies greatly in different individuals. Iodism is manifested by general *malaise* and rise of temperature, frontal headache, coryza, lachrymation, and sometimes inflammatory swelling of the eyelids, a bitter, saline taste in the mouth, soreness of the throat, hoarseness, and difficulty of swallowing—phenomena strikingly similar to summer catarrh. Indeed, patients who experience these sensations for the first time, suppose them to be an acute catarrh. Usually the symptoms of iodism subside, notwithstanding the dose which caused them may still be taken, or, as it may be expressed, a "tolerance" is established. The quantity which at one time may have caused violent iodism will not necessarily again do so, although a considerable interval may have elapsed. Indeed, it is sometimes difficult to induce iodism in those who have become habituated to the use of the iodides in considerable medicinal doses.

An eruption of acne, especially on the face, shoulders, and thighs, is a very common result of the internal use of the iodides, and this is sometimes held to be an evidence of iodism, but it appears frequently without any other symptom of this state.

Wasting of the mammæ and of the testes has never been observed by the author, although he has used the largest doses of the iodides, and for long periods. There is no doubt about their antaphrodisiac effects, and it has seemed to the author that permanent loss of sexual power has resulted from their long-continued use.

When it is desirable to avoid iodism, large draughts of water should be taken during a course of the iodides. As Rosenthal has shown, large dilution of the salt hastens elimination, and thus prevents the more severe effects of iodism.

Benedict has experimentally studied the effects of iodine and of iodide of potassium on the nervous system. His observations, made on frogs, demonstrated that these agents caused paralysis of the heart and of the respiration, but there are no facts indicating that on man they possess this power. It is true Schule had a case in which such symptoms were induced by injecting the sac of a *spina bifida* with tincture of iodine, but the direct and reflex effects of the injection on the spinal cord may have had much to do with the result. The nervous symptoms which accompany iodism are apparently due solely to the increase in the pulse-rate, the elevation of temperature, and the irritation of the broncho-pulmonary mucous membrane.

THERAPY.—A weak solution of the iodide of potassium (grs. j—grs. v—℥ j) is a useful application to the mouth in *aphthæ*, *mercurial stomatitis*, *simple sore-throat*, *tonsillitis*, *etc.* *Hypertrophy of the tonsils* can usually be cured by the injection of the tincture of iodine into their substance. To execute this little operation, an hypodermic syringe, with a sufficiently long needle, is necessary.

The *vomiting of pregnancy* can sometimes be greatly relieved by drop-doses every hour or two, of the tincture of iodine. This, like all other remedies for this disorder, is very uncertain, and precise indications for its use have not hitherto been ascertained. *Catarrh of the duodenum*, *catarrh of the biliary ducts*, and the *jaundice* dependent thereon, are, after the acuter symptoms have subsided, cured by small and frequently-repeated doses of the iodide of ammonium (grs. j—iij in water every two, three, or four hours). This is also the best remedy for the first stage of *cirrhosis*. The efficacy of the iodide is increased by combination with arsenic: ℞. Ammonii iodid., ʒ j; liq. potassii arsenitis, ʒ ss; tinct. colombæ, ℥ ss; aquæ, ℥ jss. M. Sig. A teaspoonful three times a day, before meals.

The preparations of iodine and the iodides are, generally speaking, contraindicated in all inflammatory states of the intestinal canal; but in *passive hæmorrhage*, and *diarrhœa* from atony of the mucous membrane, the tincture or compound solution of iodine in small doses—one or two drops—frequently repeated, renders important service (Schmidt).

Large doses (grs. xv—ʒ ss) of the iodide of potassium, three or four times a day, often afford remarkable relief in *aneurism*, and sometimes effect a cure. This mode of treatment is adapted to internal aneurisms so situated as to be beyond the reach of surgical means. The author has seen several instances in which great relief was experienced, and one case certainly in which a cure apparently resulted. He is, therefore, able to confirm the observations of Chuckerbutty, Roberts, Balfour, and others.

The iodides are unquestionably serviceable in *acute catarrh*. The action is local and substitutive. A grain of the iodide of ammonium every two hours has seemed to the author the best mode of applying the remedy. In *summer catarrh* or *hay-asthma*, the best results are obtained by the use of larger doses, and the efficacy of the iodides is increased by combination with arsenic. ℞. Potassii iodidi, ℥ j; liq. potassii arsenitis, ʒ j; aquæ, ℥ iv. M. Sig. A teaspoonful every four or six hours. With the internal use of the iodides may be combined the local use, to nares and fauces, of the following solution: ℞. Tinct. iodinii, ʒ j; acid carbol., gtts. x; aquæ destil., ℥ iv. M. Sig. Apply with a post-nasal syringe. Local applications will be effective, when the morbid action is confined to the nares and fauces.

The iodide of potassium is one of the most effective remedies which we possess for *spasmodic asthma*. But it is not adapted to all cases arising under various conditions—a fact which explains the difference of opinion on the subject between Williams, Salter, and others. It is most beneficial when the asthmatic seizures are induced by an acute bronchial catarrh, the nervous symptoms being reflex; and when there occurs during an asthmatic attack profuse bronchial secretion. Salter, however, holds that we possess no exact indications for its use, and that cases the most diverse are sometimes benefited in a remarkable manner. As regards doseage, from fifteen to thirty grains every two, three, or four hours, according to the severity of the seizure, is usually the necessary quantity.

Chronic bronchitis, with profuse secretion (bronchorrhœa), is frequently improved by the iodides, more especially the iodide of ammonium. The efficacy of this remedy is increased by the conjoined administration of arsenic. In *capillary bronchitis*, the author has witnessed most astonishing relief by the rapid administration of iodide of ammonium in small doses. It may be combined with the carbonate, or with the stimulant expectorants. To prevent caseation of the inflammatory exudations of *catarrhal* and *fibrinous pneumonia*, no remedy is more efficient than the iodide of ammonium. To lessen the effect of this remedy on the tissue-changes, arsenic should be combined with it, and every means used to support the body nutrition. The iodide of potassium is one of the remedies resorted to in *chronic pleurisy*, to promote absorption of effusions. In these cases the chest is painted with the tincture, and the iodides are administered steadily for a considerable period.

Affections of the broncho-pulmonary mucous membrane, alluded to above, in which there is profuse exudation, all inflammatory symptoms having subsided, are advantageously treated by iodine inhalations. The method which the author has found most convenient is the following: A small, wide-mouthed bottle, containing a moistened sponge, is placed in a vessel of hot water. The tincture of iodine (gtts. v—gtts. x) is dropped upon the sponge, and as the vapor of iodine rises, is inhaled with the vapor of water. This inhalation is serviceable in *acute catarrh*, *hay-asthma* and *chronic bronchitis*. The carbolate of iodine (tinct. iodinii, ℥ ss; acid. carbol., ʒ j) may be used instead of the simple tincture of iodine.

But few affections of the brain, non-specific in origin, are benefited by the iodides. According to Niemeyer, the iodide of potassium given to iodism has in few instances cured *basilar meningitis*. The author, who has used it faithfully in various cases, has not been so successful. Trousseau et Pidoux express their disbelief in the reported cures of tubercular meningitis by this agent.

No remedy is more efficient in the treatment of certain glandular enlargements of the thyroid, spleen, and lymphatic glands. *Goitre* is curable by the internal and external application of iodine, when it consists of simple hypertrophy of the gland-elements. Cystic and calcareous degeneration of the thyroid are unaffected by the use of iodine preparations never so vigorously used. One of the best remedies for true goitre, as will be seen hereafter, is the unguentum hydrarg. iodidi rubri. *Enlarged spleen*, when it consists merely of an hypertrophy of the organ (chronic splenitis), is cured by the internal use of the iodides conjoined with the local use of iodine-paint, or ointment of the red iodide of mercury. The *enlargements of the spleen and liver*, with *functional derangement of these organs*, which are caused by malarial disease, are most effectually removed by moderate doses, frequently repeated, of the iodide of ammonium. The author's experience justifies him in strongly urging the combined use of iodide of ammonium and arsenic in *chronic malarial poisoning*.

The prolonged administration of iodide of potassium has appeared in some instances to have retarded the changes which ensue in *chronic Bright's disease* (fibroid degeneration), and to have improved the condition of the patients.

The utility of the iodides is most conspicuous in certain *constitutional states*. The expectations which were at first entertained of the cure of *scrofula* by iodine and its preparations have not been realized. The iodides are unquestionably useful in the *scrofulous* (so called) *enlargements of the lymphatic glands*, but cod-liver oil and suitable hygienic means are more influential in improving the strumous diathesis. The preparations of iodine are effective only when simple hypertrophy of the lymphatic glands has taken place; if they have undergone caseation, or have proceeded to suppuration, no medicine has any influence over them.

The most important therapeutical applications of the preparations of iodine are in the treatment of *constitutional syphilis*. For the primary and secondary stage, mercury is generally admitted to be best; but for tertiary symptoms no remedy at all approaches the iodide of potassium. In the secondary affections of the skin, mercury, especially if it have not been given for the primary troubles, is to be preferred in the papular, tubercular, squamous, and pustular syphilides; iodide of potassium in the ulcerating, especially if the patient is cachectic. It may be stated in general that the preparations of iodine are indicated when the patient is under the mercurial cachexia. On the other hand, it is well known that sometimes even when the tertiary symptoms have not been relieved by a thorough course of iodides, mercury will quickly remove them. But this fact does not invalidate the rule that the iodides are specially serviceable for the tertiary period.

No therapeutical fact is more conspicuous than the cure of *syphiloma of the nervous system* by iodides. *Mental disorders*, *epileptiform seizures*, *paralytic states*, etc., dependent on gummata, nodes, etc., are usually removed in a manner little short of magical. *Neuralgia of the fifth* (*tic-douloureux*), the pain being nocturnal chiefly, or *nocturnal pain in the head*, is similarly promptly cured. In syphilitic affections of the brain, more imperatively than in the same affections of other organs, are large doses of the iodide of potassium required. The limitation of the dose depends entirely on the physiological susceptibility of the patient, and the influence exerted over the progress of the case. Hence the dose may vary from ten grains to a drachm every four hours, or three or four times a day. The symptoms of iodism—the use of the agent to saturation—should be induced; for this effect is the only measure of the therapeutical power of the remedy. The more promptly iodism can be induced, the better, for the soft nervous tissue may be quickly and irreparably damaged by syphilitic deposits and new growths. *Syphilitic paraplegia* is equally amenable to the same means; but, as above remarked, much depends on the promptness with which the iodide is used.

The various *neuralgiæ of syphilitic origin*, occurring in any situation, are usually very promptly cured by the iodide of potassium. The distinctive feature of syphilitic neuralgia is its nocturnal character; but it is said that ordinary neuralgia, the pain of which is increased at night, is also relieved by full doses of the iodide. Cases non-syphilitic, thus improved or cured, are most probably dependent on saturnine, mercurial, or other mineral poison.

There is no therapeutical fact more conclusively established than the power of iodide of potassium in large doses to arrest destructive *syphilitic ulcerations of the nares, palate, tonsils, and larynx.* Not unfrequently, as is well known, rapid destruction of these parts ensues, and hence it is extremely important to arrest it at the earliest moment.

From twenty grains to a drachm of the iodide, every four hours, may be needed for this purpose. Equally efficient is this treatment in the case of *syphilitic deposits* in the lungs simulating phthisis; but these syphilitic deposits should not be confounded with the caseous and tubercular masses which may appear in the lung during the existence of a syphilitic cachexia. The former is amenable to the specific iodide-treatment; the latter, not. *Syphilitic disease of the liver, spleen, kidneys, or other viscera*, is to be treated by the iodides according to the principles already laid down.

Chronic rheumatism, when there are present thickening of the fibrous tissues, and inflammatory depositions about joints, tendons, periosteum, and nerve-trunks, is often very signally benefited by the iodides. The cases in which these remedies prove so serviceable are most probably due to syphilitic, mercurial, saturnine, or other constitutional causes. There are, in our modern life, many ways in which these mineral poisons enter the organism, and it is probable that they are often undiscovered and even unsuspected causes of rheumatic symptoms. *Lumbago*, *sciatica*, and *paraplegia*, apparently of rheumatic origin, and curable by the iodides, may not unfrequently be caused by syphilis, mercury, copper, tin, or lead.

The *various accidents caused by the metals above named*, especially the *mercurial* and *saturnine*, are removed by the use of the iodides, notably by the iodide of potassium. With regard to the dose necessary, what is true of syphilis is equally true of the mineral poisons: in order to remove them, the organism must be saturated by the remedy. From fifteen grains to a drachm, three or four times a day, should be given; but the measure of the quantity required is the effect produced. The iodides penetrate into every tissue, convert the deposited metal into soluble combinations, and cause them to be discharged by the various organs of excretion, chiefly by the kidneys. It has been repeatedly asserted that salivation may be induced, and existing salivation increased, by the use of the iodides for the removal of mercurial salts from the organism; but the author has not witnessed any facts which support this statement.

In *skin-diseases of syphilitic origin* there can be no question as to the utility of the iodides. But these remedies are more especially curative in the tertiary affections, especially in destructive syphilitic ulcerations. Hebra insists, and with justice, that the preparations of iodine are only useful in *lupus*, whether syphilitic or scrofulous, and do not permanently improve other cutaneous diseases. Mr. Hutchison calls attention to the fact that the various skin-diseases classed as hydroa may be produced by the iodide of potassium. The author has certainly had one case illustrating this action of the iodide.

LOCAL USES OF THE PREPARATIONS OF IODINE.—The tincture of iodine is in universal use as a counter-irritant. It is applied by means of a camel's-hair brush to *goitre*, to *enlarged glands*, and to superficial *inflammatory swellings* before the formation of pus. Painted over the neck, it is a useful counter-irritant in *acute affections of the pharynx and larynx*, and to the chest to relieve the *chest-pains* which occur in *phthisis*. It is the most serviceable counter-irritant to promote absorption of inflammatory products in *catarrhal* and *fibrinous pneumonia* after the acuter symptoms have subsided. The same application appears to possess the power to promote the absorption of *pleuritic effusion*. It is a good plan in these affections to paint, on successive days, the tincture over the front, the lateral, and the posterior wall of the chest, so that one surface has time to recover from the irritation before it is again attacked. As the susceptibility to the action of the iodine varies in different subjects, it is always prudent to make a slight application in the beginning. If extreme burning follow the applications, the iodine may be dissolved off by a solution of iodide of potassium, by alcohol or ether.

The tincture and the ointments of iodine are also used to remove the *induration of the breasts* which results from attacks of inflammation. It must be remembered that the integument in this situation is extremely sensitive to irritating applications. *Splenic and hepatic disorders of a chronic kind* are frequently treated locally by the application of tincture and ointment of iodine. Enlarged spleen of malarial origin is more speedily cured by the application of the officinal red iodide-of-mercury ointment, and, as regards hepatic disorders, the only affection which has seemed to the author to be benefited by iodine applications is the engorgement due to malarial attacks.

After the acute symptoms have subsided, tincture of iodine will remove the swelling of *orchitis*. The scrotum, like the female breast, is very sensitive to the irritation of iodine-tincture and ointments. *Bubo*, like the enlarged lymphatic glands in other situations, may be treated by the application of iodine-tincture, but it is not very effective.

Although Hebra does not approve of the internal use of iodine in cutaneous diseases, he advises the local application. He employs the tincture or glycerine solution in *chloasma*, *lentigo*, and *lupus*. The tincture of iodine is used to prevent the *pitting of small-pox*. According to Piringer, it should be applied as follows: If on the first day of the eruption, the whole face, including the eyelids, is brushed over with the tincture of iodine ten times, there being an interval of a half-hour between each application; if on the second day, twelve applications; if on the third day, twelve to sixteen applications. The tincture of iodine is sometimes painted over the affected surface in erysipelas, and over the surrounding healthy integument, to prevent the spread of the disease, but, according to the author's experience, it is a bad practice.

Iodoform may be substituted for iodine in the form of ointment (℈j—ʒj—℥j). This may be used locally, rubbed in, as the iodine-ointments are, for the relief of local inflammatory swellings, enlarged lymphatic glands, goitre, etc. The strong, diffusive, and peculiar odor of iodoform is an objection to its use in this way. Iodoform powdered and dusted over the diseased surface is an excellent application to *sloughing and ill-continued wounds*, *irritable ulcers*, *rodent ulcer*, *chancroid*, *sloughing phagedena*, and *serpiginous syphilitic ulcers*. It allays pain, changes the morbid action, and is antiseptic. *Syphilitic ulcers of the tonsils*, *pharynx*, *and tongue*, are most effectually treated by local and direct application of powdered iodoform. In these cases the powder may be blown on to the surface of the ulcer by an insufflator or insufflation-tube. *Fissures of the anus*, *hæmorrhoids*, *and ulcers of the rectum*, are improved in condition, and the pain which attends them relieved by application of the ointment of iodoform and by iodoform suppositories. The latter are also of undoubted service in *chronic metritis* and *hypertrophy of the prostate* when introduced into the rectum; the iodoform diffuses into the neighboring organs, and acts directly upon them. The *pain of cancer* may be somewhat relieved, and the *fetid odor* which attends the discharges may be removed, by the application of iodoform to the diseased surface. This treatment may be applied to cancer in any situation, but is especially applicable to cancer of the uterus and rectum.

The *parenchymatous injection* of tincture of iodine is a remedial means of great importance. The method of employing it is exceedingly simple. An ordinary hypodermic syringe (glass or hard rubber) is charged with five to fifteen minims or more of the tincture, and the needle is thrust deeply into the affected tissue, and the iodine is slowly discharged. For injection into parts very deeply situated, long needles, such as are made for aspiration, can be used. This method of treatment is very effective in *hypertrophied tonsils*, *goitre*, *glandular tumors*, and the *compound cystic and glandular growths* so frequently found in the neck. The author has witnessed the cure of many cases of this kind by the parenchymatous injection of tincture of iodine. Some precautions must be attended to in practising these injections. When the point of the needle is inserted as deeply as desired, it should be moved about to disengage it from any vessels into which it may have penetrated. The injection should be practised slowly, to give time for the tincture to diffuse into the substance of the tumor. It need hardly be remarked that the superficial vessels of the neck should be avoided in inserting the needle.

When *hydrothorax* returns after evacuation of the cavity by the trocar, the compound solution of iodine (℥ ss) or the tincture (ʒ j) may be injected into the pleural sac. In *empyema*, the undiluted tincture of iodine may be thrown in without risk, and with great benefit. Ordinarily, a solution of the following strength may be used to wash out the cavity in cases of empyema: ℞. Liq. iodinii comp., ℥ j; aquæ, ℥ xv. M.

Hydatids of the liver may easily be destroyed by injecting into them a few drops of tincture of iodine. It has, however, been shown that simple capillary puncture and withdrawal of the fluid suffice to arrest the growth and to abort these parasites. Injection of tincture of iodine is one of the means resorted to to cure *hydrocele.*

It is said that *hypertrophied prostate* may be diminished and further enlargement prevented by parenchymatous injection of iodine. In the performance of this operation a Sims or bivalve rectal speculum is inserted, and the needle of the syringe is passed through the walls of the rectum into the gland. Careful palpation previous to the insertion of the needle will enable the operator to avoid important vessels.

Unilocular ovarian cysts may sometimes be cured by injecting into them, after the withdrawal of the fluid, ten to sixteen ounces of tincture of iodine. No other form of ovarian cyst will, however, be affected favorably by this expedient.

Large abscesses may be made to close much more speedily than they would otherwise, and septic infection be prevented, by the injection of iodine tincture after the evacuation of the matter.

Numerous cases of *spina bifida* have been cured by the injection into the sac of tincture of iodine (ʒ ss) or a solution of iodine (gr. ss) and iodide of potassium (gr. v) in water (ʒ j).

Iodo-Tannin.—This is an excellent application for local diseases. Tannin may be dissolved to saturation in tincture of iodine, or an aqueous solution may be prepared as follows: ℞. Iodinii, ʒ j; acid. tannici, ℥ j; aquæ, Oj. After filtration to be evaporated to ℥ iv.

The author has found a saturated solution of tannin in tincture of iodine a most efficient application in all those cases of *uterine disease* in which the tincture of iodine and iodized cotton and iodized glycerine are now so much used. It is serviceable in *chronic cervicitis, chronic endo-metritis, sub-involution and hypertrophy of the uterus.* The author has also found that the following combination is a capital application in *leucorrhœa* and the above-named uterine affections: ℞. Iodoformi, ʒ j; acid. tannici, ℥ j. M. Sig. A sufficient quantity to be packed in the dry state around the cervix.

The *iodide of starch* is used by Mr. Marshall as a dressing for syphilitic ulcers, and he speaks highly of its efficacy.

A decolorized tincture of iodine for external use may be prepared as follows: iodine, hyposulphite of sodium, distilled water, of each ten parts. Dissolve with a moderate heat, and add sixteen parts of spirits ammonia, and, after a few minutes' agitation, add seventy-five parts of alcohol. The solution must stand in a cool place for three days, and then be filtered (Waldenburg und Simon).

An extemporaneous *iodo-tannin* may be prepared according to the formula of Sigmund: ℞. Tinct. iodinii, tinct. gallæ, āā ℥ ss. M. The strength of this may be increased by the addition of iodine

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MERCURY AND ITS PREPARATIONS.

Hydrargyrum.—Mercury. *Mercure*, Fr.; *Quecksilber*, Ger. A silver-white metal, liquid at common temperatures, and having the specific gravity 13.5. It is wholly volatilized by heat, and is dissolved without residue by nitric acid.

Preparations.—*Emplastrum Ammoniaci cum Hydrargyro.*—Plaster of ammoniac with mercury. Composition: Ammoniac, 12 ounces; mercury, 3 ounces; olive-oil, 60 grains; sublimated sulphur, 8 grains.

Emplastrum Hydrargyri.—Mercurial plaster. Composition: Mercury, 6 ounces; olive-oil and resin, of each, 2 troy-ounces; lead-plaster, 12 troy-ounces.

Hydrargyrum cum Creta.—Mercury with chalk. Composition: Mercury, 3 troy-ounces; prepared chalk, 5 troy-ounces. "A gray powder partly dissipated by heat. When a small portion is treated with dilute acetic acid in excess, it is partly dissolved, nothing remaining but mercury in the form of minute globules, visible by the aid of a magnifying-glass." Dose, gr. ss—gr. x. Eight grains contain three grains of mercury.

Pilulæ Hydrargyri.—Pills of mercury. Blue mass. Composition: Mercury, confection of rose and liquorice-root powdered. Each three grains contains one grain of metallic mercury. Dose, gr. ss—gr. xv.

Unguentum Hydrargyri.—Mercurial ointment. Composition: Mercury, lard, and suet.

Hydrargyri Oxidum Flavum.—Yellow oxide of mercury. "An orange-yellow powder, which, on being heated, assumes a red color; then, if the heat be increased, it evolves oxygen, and finally the mercury evaporates without residue."

Unguentum Hydrargyri Oxidi Flavi.—Ointment of yellow oxide of mercury. Composition: Yellow oxide, 60 grains; ointment, 420 grains.

Hydrargyri Oxidum Rubrum.—Red oxide of mercury. Red precipitate. "An orange-red powder, entirely soluble in muriatic acid. When heated it does not emit reddish fumes, but gives off oxygen, while the mercury either runs into globules, or is wholly dissipated."

Unguentum Hydrargyri Oxidi Rubri.—Ointment of red oxide of mercury. Composition: Red oxide, 60 grains; ointment, 420 grains.

Hydrargyri Sulphas Flava.—Yellow sulphate of mercury. Turpeth mineral. "A lemon-yellow powder, sparingly soluble in water. It is entirely dissipated by heat, sulphurous acid being evolved, and globules of mercury sublimed. Dose, grs. ij—grs. v, as an emetic.

Hydrargyri Chloridum Corrosivum.—Corrosive chloride of mercury. Corrosive sublimate. "In colorless crystals or crystalline masses, which are fusible, and sublime without residue. It is entirely soluble in water (1 in 15), alcohol (1 in 7), and ether. Lime-water causes a yellowish precipitate, and ammonia a white one, from its solution." Dose, gr. $\frac{1}{30}$—gr. $\frac{1}{16}$.

Hydrargyri Chloridum Mite.—Mild chloride of mercury. Calomel. "A white powder, wholly volatilized by heat, and insoluble in water, alcohol, and ether. With solution of potassa it yields a black precipitate of oxide of mercury, which is reduced by heat to the metallic state. Distilled water, after having been boiled with it, yields no precipitate with ammonia or nitrate of silver." Dose, gr. $\frac{1}{10}$—grs. x.

Pilulæ Antimonii Compositæ. — Compound pills of antimony. Plummer's pills. Composition: Sulphurated antimony, calomel, and guaiac. Each pill contains one-half grain each of antimony and calomel, and one grain of guaiac.

Hydrargyri Cyanidum.—Cyanide of mercury. "In white prismatic crystals, wholly soluble in water. When muriatic acid is added to the solution, hydrocyanic acid is evolved, made evident by its odor, and bichloride of mercury is left, which is entirely volatilized by heat. Dose, gr. $\frac{1}{20}$—gr. $\frac{1}{6}$.

Hydrargyrum Ammoniatum.—Ammoniated mercury. White precipitate. "In white powder or pulverulent masses, decomposed and entirely dissipated by a strong heat, insoluble in water and alcohol, but dissolved without effervescence by muriatic acid."

Unguentum Hydrargyri Ammoniati.—Ointment of ammoniated mercury. Composition: Ammoniated mercury, ℈j; ointment, a troy-ounce.

Hydrargyrum Iodidum Viride.—Green iodide of mercury. "A greenish-yellow powder, which becomes red when heated. It is insoluble in water and alcohol." Dose, gr. $\frac{1}{6}$—gr. j.

Hydrargyri Iodidum Rubrum.—Red iodide of mercury. "A red powder, which becomes yellow when heated, and red again when cold. It is wholly volatilized by heat, condensing in scales, which are at first yellow, but afterward become red. It is insoluble in water, but is dissolved by boiling alcohol, and by solutions of iodide of potassium and chloride of sodium." Dose, gr. $\frac{1}{30}$—gr. $\frac{1}{10}$.

Unguentum Hydrargyri Iodidi Rubri.—Ointment of red iodide of mercury. Composition: Red iodide, 16 grains; ointment, a troy-ounce.

Hydrargyri Sulphuretum Rubrum.—Red sulphuret of mercury. Cinnabar. "In brilliant crystalline masses, of a deep-red color and fibrous texture. It is entirely volatilized by heat. When heated with potassa, it yields globules of mercury. It is not soluble in either nitric or muriatic acid, but is dissolved by a mixture of the two. Acetic acid which has been digested with it does not yield a precipitate with iodide of potassium."

Liquor Hydrargyri Nitratis.—Solution of nitrate of mercury. Mercury dissolved in nitric acid. Acid nitrate of mercury. "A transparent, nearly colorless, acid liquid, having the specific gravity 2.165. It is not precipitated by the addition of distilled water; and the diluted solution affords, with potassa, a dirty-yellow precipitate, and with iodide of potassium a bright-red one, soluble in an excess of the precipitant. When dropped on a bright surface of copper, the diluted solution instantly deposits a coating of mercury."

Unguentum Hydrargyri Nitratis.—Ointment of nitrate of mercury. Citrine ointment.

Unguentum Hydrargyri Nitratis Rubrum.—Brown citrine ointment. Unofficinal. This differs from the preceding and officinal citrine ointment, in being made with cod-liver oil. It is dark brown in color, more agreeable in odor, and more efficient as a remedy.

Oleate of Mercury is an unofficinal preparation for external use, consisting of a solution of oleate in oleic acid. It is a liquid of the consistence of glycerine, or a soft solid. Applied to the skin by a brush, without friction, or with moderate friction, it produces the constitutional effect of mercury and very promptly.

ANTAGONISTS AND INCOMPATIBLES.—Corrosive sublimate is incompatible with alkalies and their carbonates, lime-water, tartar emetic, nitrate of silver, acetate of lead, albumen, iodide of potassium, soaps, various vegetable infusions, including cinchona. Calomel is incompatible with the alkalies, and alkaline earths and alkaline carbonates, with iron, lead, and copper. It should not be given in the same prescription with iodine (forms red iodide), and nitro-muriatic acid should not be prescribed in conjunction with it, lest corrosive sublimate be formed.

There is little doubt, also, that calomel is converted into corrosive sublimate by the chlorides of sodium, potassium, and ammonium. The acids and acidulous salts are incompatible with hydrargyrum cum creta.

In cases of poisoning by mercurial salts, especially corrosive sublimate, albumen, white of egg, wheaten flour, milk, etc., may be administered. The white of one egg is considered sufficient for four grains of corrosive sublimate. An excess of albumen may redissolve the compound. Emesis should be promptly induced.

SYNERGISTS.—Depressing medicines, antimony, alkalies, especially alkaline chlorides, etc., promote the physiological activity of mercurials.

PHYSIOLOGICAL ACTIONS.—Metallic mercury in direct contact with the skin or mucous membrane is without action. Swallowed, it is purgative by virtue of its weight. If retained in the intestinal canal, it will form soluble combinations, enter the blood, and produce characteristic systemic effects. Similarly prolonged contact with the skin will be followed by the constitutional action of the drug. Injected into the veins, it will be arrested in the capillaries, producing the usual phenomena of capillary embolism. Mercury gives off vapors at the ordinary temperatures, which have, in notable instances, caused serious constitutional symptoms. As used in the mechanical arts, by gilders and others, the fumes of mercury cause wasting, ptyalism, necrosis of bones, trembling, impaired intellect, and in women, abortion. Without producing such obvious effects as ptyalism, mercurial cachexia, eczema, and disease of the bones, obscure nervous phenomena may result. Among these may be enumerated headache, loss of memory, trembling, defects of coördination, disorders of sensation, convulsions, and dementia.

Mercury is readily absorbed—as a vapor by the pulmonary mucous membrane, when applied to the integument, or when taken into the alimentary canal. It probably exists in the blood as an albuminate. Recent experiments (Wilbouchewiez, Keyes) have shown that mercury, as iron, manganese, and other metals, has the power to increase the number of red corpuscles, and to improve the quality of the blood, provided it is exhibited in small quantities, not often repeated. It has long been known (Liegeois) that this result followed the use of corrosive chloride in syphilis. The improved methods of counting the number of corpuscles within a given area have alone rendered possible an exact determination of such a delicate question. It remains true, however, that any considerable quantity of mercury, administered a sufficient time, will affect the quality and composition of the blood: the red globules are diminished in number; the fibrine loses its plasticity; the proportion of water is increased, and various effete materials, whose nature is unknown, accumulate. Mercury is deposited in all the textures, interferes with the normal nutritive processes, and is found in all the secretions and excretions. A marked degree of anæmia, loss of flesh, muscular weakness, intractable ulcerations of the skin, loss of hair, eczema, a foul breath, diarrhœa, the stools being very fetid, are the characteristic symptoms of the action of mercury on the solids and fluids of the body.

This metal has a selective action on the lymphatic glandular system, and notably on the salivary glands and pancreas. Among the earlier symptoms of the action of mercury are an increase of the salivary secretion, an alteration of its quality, fetor of the breath, swollen tongue, soreness of the teeth, a blue or dark slate-colored line along the margin of the teeth, sponginess of the gums, swelling of the parotid, sublingual, and submaxillary glands, aching of the jaws and teeth, with general muscular soreness and aching of the limbs, and some elevation of temperature. To this state are applied the terms *acute mercurialismus*, *ptyalism*, in common language, *salivation*. Mercury certainly stimulates the pancreas; this gland, like the salivary glands, becomes swollen, congested, and pours out an abundant secretion which, however, is not a normal but a pathological secretion. There is little doubt also that mercury increases the action of the intestinal glandular appendages, and thus acts as a purgative. It not only increases the activity of these glands, but is itself in part excreted by them. The products of the increased waste of the tissues caused by mercury are also largely eliminated by the intestinal glands. These actions of mercury should not be regarded as a physiological stimulation of the intestinal glands, in the sense that the foods are stimulants to these organs. The action is pathological, and the products of the action are pathological.

Mercury, like the metals in general, is excreted by the liver, and manifests a tendency to accumulate in this organ. Like the metals in general (iron, manganese, arsenic, copper, etc.), mercury doubtless acts as a stimulant to the hepatic cells, and increases their products. Just as an altered salivary or pancreatic fluid is produced by the action of mercury, so an altered or pathological bile is the result of the stimulation of the hepatic cells, by this metal. That its use increases the physiological and normal products of the liver seems an assumption hardly warranted by the facts which have now been accumulated. That mercury (pil. hydrarg., calomel, hydrarg. cum creta), in purgative doses, increases the flow of bile into the intestine—is a cholagogue—cannot be successfully disputed; but it is a cholagogue in the sense that croton-oil and the resinous purgatives are: by irritation of the mucous membrane of the duodenum, it causes a reflex contraction of the gall-bladder and hepatic ducts, and an outflow of bile is the result. The presence of alimentary matters in the duodenum suffices to increase the production and discharge of bile; purgatives, for the time being, somewhat more energetically produce the same result. A purgative dose of blue-pill, or calomel, may therefore cause bilious evacuations, but other purgatives may accomplish the same. Repeated stimulation of the liver by mercurials can only result in the production of an altered bile, and may, indeed, cause the organ to strike work, if too long persisted in

If we add to the cholagogue properties of mercury, which it possesses in common with resinous purgatives, the action on the pancreas and the increased elimination of the products of waste by the intestinal glands, we obtain a satisfactory explanation of those powers which have, under the term *alterative*, been heretofore ascribed to mercury.

Mercury is eliminated by the salivary and the intestinal glands, by the liver, but chiefly by the kidneys. A small portion of the metal escapes by the skin also. The excretion of mercury is hastened and completed by the iodide of potassium. As a result of the changes in the composition of the blood, and of the direct action of the metal on the renal epithelium, albuminuria is one of the symptoms present in cases of mercurialism. Without the use of special means to render it soluble, and despite the use of such means, sometimes mercury remains permanently in the organism. When extremely severe cases of salivation were not uncommon, permanent damage to the osseous structures often occurred, and globules of mercury could be shaken out of the dried bones of such subjects. Happily, nowadays, such cases do not occur. The moderate use of mercury, short of ptyalism, does not appear to affect the human system injuriously.

EFFECTS OF THE DIFFERENT PREPARATIONS.—Hydrargyrum cum creta, calomel, and blue-pill are very similar in action. Calomel, being insoluble, probably escapes solution and combination in the stomach, and is decomposed by the alkaline contents of the small intestine, the oxide of mercury being precipitated. It follows, from this reaction, that the effects of blue-pill and calomel must be similar, and in practice it is found that they correspond closely therapeutically. Salivation more frequently results from the use of blue-pill than the other mercurials; and calomel is next in point of activity in this respect.

The corrosive chloride, the red iodide, and the cyanide, are powerful irritant and corrosive poisons. When a poisonous dose of corrosive sublimate has been swallowed, the mucous membrane of the mouth has usually, but not invariably, a whitish, glazed appearance, as if it had been washed over with a strong solution of the nitrate of silver. A sense of constriction of the throat and a strong styptic and metallic taste are experienced. The toxic symptoms follow in a few minutes the ingestion of the poison. Usually, violent pain is felt in the abdomen, but this is not invariable. Vomiting follows, and the vomited matters consist at first of the contents of the stomach, and afterward of mucus streaked with blood. There are usually purging, tenesmus, intestinal cramp, and not unfrequently dysenteric discharges. These evidences of violent gastro-intestinal irritation are accompanied by small, weak pulse, coldness of the surface—but sometimes by a swollen and flushed face—sighing respiration, syncope, insensibility, or convulsions. If the patient survive a few days, ptyalism may occur.

The following are the symptoms of chronic poisoning: abdominal pains; nausea; vomiting; dysenteric diarrhœa; general weakness, trembling, or paralysis; ptyalism; fever; emaciation, etc. There sometimes occurs a blue line along the margin of the teeth, not unlike that produced by lead.

Suppression of urine is a not infrequent symptom in acute poisoning, and albuminuria is very often present in cases of chronic mercurialismus.

THERAPY.—The acute glandular affections of throat and neck—*tonsillitis, parotitis, inflammation of the submaxillary and sublingual glands*—are often speedily removed by mercurial preparations. The one-twentieth of a grain of calomel, the one-fifth of mercury with chalk, may be given every two hours, or five minims of the following solution may be administered at the same interval: ℞. Hydrarg. chlor. corrosiv., gr. j, aquæ, ℥ j. M. S. Dose, minims v. Chronic affections of these organs are not benefited by these remedies, and the so-called scrofulous diseases of the cervical glands are made worse by them.

Corrosive sublimate is an effective remedy in *gastric ulcer.* The thirtieth to the sixtieth of a grain, three times a day before meals, is a proper quantity and occasion for this purpose. Certain kinds of *vomiting* are quickly cured by small doses of calomel. The *vomiting of children*, caused by indigestible food, or by constipation, or by these causes combined, is often speedily relieved by one-twelfth-of-a-grain doses of calomel every half-hour or hour, dropped on the tongue. This remedy is the more efficacious when such vomiting is accompanied by great heat of head, restlessness, and fever. The vomiting of *cholera infantum* is often stopped by the same means.

It has long been held that mercurials are specially indicated in that *catarrhal state of the intestinal mucous membrane and of the hepatic duct*, manifested by nausea, anorexia, tympanites, whitish or clay-colored stools, and jaundice. The use of mercury in these cases is predicated on its supposed power to promote the flow of bile. It is true, no doubt, that calomel and blue-pill will remove these symptoms, but such mild salines as phosphate of soda, sulphate of magnesia, tartrate of soda and potassa, etc., will usually succeed quite as well and without detriment. The *diarrhœa and dysentery of infants* (ileo-colitis) is frequently treated by minute doses of calomel or hydrargyrum cum creta. When there are much straining and bloody mucus, it is said that small doses of corrosive chloride prove very effective, but the author is convinced that mercurials are much abused in these affections. Children are quickly poisoned by mercurials, although they are not easily salivated. The spinach-colored stools which so frequently occur in the summer complaint of children, and which are, by ignorant practitioners, supposed to be produced by the mercury administered, really belong to cases of ileo-colitis, and may, by their persistence and profuseness, signify an increased irritation of the intestinal mucous membrane due to the remedies given. While the author believes that other medicines are more useful than mercury in the ileo-colitis of children, he is convinced of the utility of minute doses of calomel (one-twentieth to one-twelfth of a grain every half-hour) when there is much irritability of the stomach. Mercurials are contraindicated in the *diarrhœa and dysentery* of adults.

It was formerly an article of faith to hold that mercury was a sovereign remedy in *hepatic disorders.* The state known as *biliousness*, characterized by a yellowish-coated tongue, yellow conjunctivæ, muddy skin, nausea, constipation, may be removed by a mercurial purge when these symptoms are due to catarrh of the duodenum, excesses of the table, sudden checking of the perspiration, etc. The blue-pill, or mercury with chalk, or calomel, succeeds in these cases by removing offending substances from the intestinal canal, by relieving a catarrhal state of the mucous membrane, or by causing elimination of waste products by the intestinal glandular apparatus. Less objectionable agents may be employed with equal success.

The experience of the India medical officers has shown conclusively that mercurials are harmful in *acute hepatitis*, *hepatic abscess*, *jaundice from gall-stones*, *acute yellow atrophy*, etc. As these affections are very rife in India, an experience which has led to such conclusions should be heeded. There is no evidence to show that mercurials render the least service in *cirrhosis.*

Calomel is a very efficient *purgative.* It will be retained when other purgatives are rejected by the stomach; it is free from taste, and may therefore be given easily to children. When it operates, nausea and tormina may be experienced. One grain of calomel at night will act in the morning, and not unfrequently a half-grain will give satisfactory results. A full purgative dose of calomel (five grains) is an excellent *vermifuge* for the *lumbricoid worms.* It may be given with santonine. At the onset of *acute febrile diseases*, calomel is a useful purgative; it hastens waste, and causes the elimination of the products by the intestine.

Mercurials were formerly much esteemed in the treatment of *acute inflammation*, especially of serous membranes. As calomel, the mercurial preparation usually employed, was combined with opium, it was not known to which remedy the good results were due, but the mercurial was considered to have the larger share of merit. It is now admitted that opium was the effective agent. An apparent exception to this statement exists in the case of *iritis*, a disease in which the good effects of mercury are most conspicuous; but iritis, probably, is always of syphilitic origin, and, in *syphilitic inflammation* of *serous membranes*, it is not disputed that mercurials are extremely efficacious. In these days, however, although opium is considered indispensable in peritonitis, pleuritis, pericarditis, etc., mercury is no longer combined with it. No longer is it considered necessary to "touch the gums" in order to cure a serous inflammation, and only the most prejudiced and benighted practitioners persist in the use of mercurials in these inflammatory affections.

Large doses of calomel—five grains every four hours—are said to be very efficacious in *true croup or membranous laryngitis.* It is claimed that it allays spasm and checks the formation of the false membrane. The author is skeptical in regard to the utility of calomel in this affection. There is, however, no doubt as to the value of the yellow subsulphate (turpeth mineral) as an emetic in this disease. If given early, so high an authority as Dr. Fordyce Barker, of New York, claims that a fatal result will most certainly be averted. From three to five grains of the subsulphate may be given as an emetic for a child with croup. Serious results might be produced by this dose if emesis did not so promptly follow. The powder comes up with the contents of the stomach, in from five to fifteen minutes after being swallowed. But little depression follows the emesis produced by turpeth mineral, in which respect it has a decided advantage over sulphate of copper, tartar-emetic, and even ipecacuanha. As it is insoluble, this remedy should be rubbed up with sugar and placed on the base of the tongue.

Liebermeister, following the lead of Traube, Wunderlich, and others, has obtained surprising results from the use of calomel in *typhoid fever.* By our German *confrères* this treatment is called the *specific treatment* of abdominal typhus. It consists in the administration of ten grains of calomel in a single dose the first day, and eight grains a day for three or four days thereafter. It is a curious fact that these large doses of calomel have an antipyretic effect. According to the statistics of Liebermeister, the "specific" calomel treatment shortens the duration and lessens the mortality from typhoid fever, as compared with the non-specific, expectant, or other plans of medication.

Calomel is one of the numerous remedies used in the treatment of *cholera Asiatica.* Two methods are pursued: large doses at considerable intervals; small doses frequently repeated. The latter method is nowadays much more usually practised. It consists in giving every fifteen minutes, half-hour, or hour, the one-sixth, one-half, or one grain of calomel, combined with opium, chalk, piperine, etc. The author, who has had considerable experience in the treatment of cholera, cannot express any degree of confidence in the efficacy of this treatment. Large doses (a scruple to a drachm) sometimes appear to arrest vomiting when other means fail, but there is danger of excessive ptyalism when reaction sets in.

The most important application of mercury, therapeutically, is in the treatment of *syphilis.* It may be regarded as specific in this disease. The reaction which set in against its use a few years ago has certainly led to important modifications in the mode and quantity in which mercury should be given; but the fact has been conclusively established that mercury, in a certain sense, is antidotal to syphilis. As mercury arrests the proliferation of the syphilitic virus in the blood, this agent should be used with the earliest manifestations of the specific character of the infecting sore. Mercury is not indicated in chancroid, or non-infecting chancre, and should not be used. If the chancre have the characteristic quality of the infecting sore, small doses of one of the mercurial preparations should be begun and continued steadily until all induration has disappeared. The important point is, not to induce ptyalism. It is now conceded that the danger of a relapse will be very much lessened by continuing the mercurial treatment for some time after local manifestations have ceased. The ill effects of a mercurial course may be prevented by the use of small doses, by careful attention to hygiene, and by lessening the dose, or discontinuing the remedy entirely, whenever soreness of the jaws can be developed by smartly closing the teeth. By the adoption of these precautions, a mercurial course may be continued without important interruptions until the period of incubation has entirely passed.

Various methods are resorted to for the introduction of mercury into the organism:

1. *Inunction.*—Before practising inunction, the patient should take a warm bath, or, at least, wash the part to be operated on with soap and water. From fifteen to thirty grains of mercurial ointment is the quantity required for each inunction. The oleate of mercury in proportion of fifteen to thirty per cent. in the solution may be substituted for the ointment, but the oleate is to be applied with a brush, and not be rubbed in. Sigmund, the great advocate for the inunction method, has prescribed certain rules, which should be followed. The ointment should be rubbed in with moderate friction by the palm of the hand; on the first day on the legs; on the second day on the thighs; on the third day on the abdomen and sides of the chest; on the fourth day on the back; on the fifth day on the arms. Mercurial inunctions are not borne equally well by all patients. Some are easily salivated, and others suffer from eczema or erythema. Moreover, the inunction treatment is filthy and troublesome, and it should, therefore, be restricted to those cases in which mercurials are badly borne by the stomach.

2. *Fumigation.*—Various mercurial preparations may be used—the sulphuret, the iodide—but calomel is the best. The apparatus consists of a spirit-lamp, a plate to hold the calomel, surrounded by a shallow vessel containing water, a blanket large enough to cover the patient and the apparatus. The calomel is volatilized by the heat of the lamp, which, together with the vapor of water, is deposited on the skin of the patient. About fifteen minutes is the time required for the bath, and the quantity of calomel used ranges from eight to fifteen grains. The

method of fumigation is especially adapted to cases of tertiary, with ulcerations, when the state of the patient is such as to forbid the internal administration of mercurials.

3. *Hypodermic Method.*—This consists in the introduction under the skin of corrosive chloride, or calomel. ℞. Hydrarg. chlor. cor., gr. j; glycerini, ʒj; aquæ destil., ʒj. M. Sig. *Ten minims a dose once a day.* This method is cleanly, quick in results, and more successful than any other in preventing relapses. It has the disadvantages of giving great pain, and in frequently causing troublesome abscesses and eschars.

4. *Internal.*—This method, in the nature of things, must be most frequently resorted to. Various mercurial preparations are used by different syphilographers. The Ricord school prefer the green iodide; Sigmund, mercurial-ointment inunctions; Foerster, the yellow iodide; Berkeley Hill, the red iodide; Tilbury Fox, the cyanide; Bumstead advises mercurial pill, the green iodide, the bichloride, according to circumstances, but his preference is for the use of calomel by fumigation. That preparation of mercury is to be preferred which best agrees with the patient, is the rule.

The indications for the use of iodine preparations have already been stated, but it may be useful, now, to place in juxtaposition the comparative utility of mercury and iodine: mercury for the primary infecting sore; mercury for the affections of the skin, especially macular and papular exanthemata; iodine for the tertiary symptoms: gummata; tubercular syphilides; serpiginous ulcers; affections of the bones and periosteum, and nervous diseases.

Hydrargyrum cum creta is usually preferred for the treatment of *congenital syphilis.* Mr. Marshall recommends the twenty-per-cent. ointment (the size of a pea) of the oleate of mercury, to be placed in the axilla night and morning for five or six days.

Local Uses of Mercurials.—The acid nitrate of mercury is one of the best caustics for the destruction of *chancroid.* It should be applied with a glass rod after the surface of the sore has been well cleansed. It is now conceded that destruction of an infecting chancre does not prevent systemic infection. *Syphilitic warts* and *vegetations* on the genitals are amenable to the same treatment. *Erosions* and *ulcerated indurations* are best treated by "black-wash" (calomel eight grains—lime-water, one ounce), or "yellow wash" (one grain of corrosive sublimate to an ounce or two of lime-water). The surface of the sore may be kept wetted with these lotions.

Ricord's treatment of *condylomata* consists in washing them with a solution of chlorinated soda, and then dusting them with calomel. Mercurial applications are of very great service in cutaneous affections of syphilitic origin. A drachm of calomel to an ounce of lard makes an ointment which is very serviceable in *herpes*, *psoriasis*, and *pruritus* of the vulva and anus. Ringer speaks of calomel-ointment in terms of great praise in various *itching* affections, especially of the anus and perinæum. In *acne*, lotions containing corrosive sublimate, and ointments of green and red iodide, are much employed: ℞. Hydrarg. chlor. cor., ℈j; glycerini, ℥ss; spts. vini rect., ℥vij; spts. rosmar., ʒiv. M. For *acne* and *pityriasis* of the scalp: ℞. Hydrarg. iod. virid., gr. x; adipis, ℥j. M. ℞. Hydrarg. iod. rubri, gr. v; adipis, ℥j. M. For *acne indurata.* The following is Startin's lotion of corrosive sublimate for syphilitic eruptions: ℞. Hydrarg. chlor. cor., gr. iv; acid. nitric. dil., ʒj; acid. hydrocyan. dil., ʒj; glycerini, ʒij; aquæ, ℥viij. M. For *pityriasis*, *chloasma*, etc.

Lotions of corrosive sublimate are much employed in the treatment of parasitic skin-affections. The stronger ones must be used with caution. It is rarely necessary to use a lotion stronger than two grains to the ounce. The following is an excellent formula of Tilbury Fox: ℞. Hydrarg. chlor. cor., grs. iv; alcohol, ʒvj; ammoniæ muriat., ʒss; aquæ rosæ, q. s. ad ℥vj. M. For *scabies*, *ptheiriasis*, and *tinea versicolor.* A scruple of corrosive sublimate to the ounce of simple ointment is an effective application in *favus* and *tinea tonsurans*, when used in the early stages of these affections.

Calomel *finely levigated* and dusted over the membrane by means of a camel's-hair brush is an excellent local application in *phlyctenular ophthalmia. Eczema of the margin of the eyelids* is quickly cured by rubbing in every night, after detaching the scales, a small quantity of the brown citrine ointment. *Chronic inflammation of the external auditory meatus* is cured by the same application, viz., by allowing a small quantity of the brown citrine-ointment to remain in contact with the integument.

Mr. Marshall strongly recommends the oleates in *parasitic skin-diseases.* He employs a five-per-cent. solution of oleate of mercury in oleic acid, adding an eighth part of ether. This is applied by means of a camel's-hair brush. It is used in *sycosis*, *tinea*, and *chloasma*, *porrigo*, *pruritus ani*, and *pruritus pudendi.* The oleates are extremely serviceable remedies for the local treatment of syphilitic induration, but they are not advisable when ulceration exists.

The oleate of mercury and morphia (obtained by the addition of the alkaloid morphia) is an elegant and efficient application in *superficial inflammations, especially of joints* of the rheumatic and arthritic varieties. Inflammatory indurations, left after the subsidence of acute trouble, are removed by the same combination. For application to these purposes Mr. Marshall employs a five-per-cent., ten-per-cent., and twenty-per-cent. solution of oleate of mercury in oleic acid. To every drachm of such solution he adds one grain of morphia.

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Aurum.—Gold. (Not officinal.) *Or*, Fr.; *Gold*, Ger.

Auri Chloridum.—Chloride of gold. Needle-shaped prisms of a beautiful yellow color, deliquescent, freely soluble in water. Dose, gr. $\frac{1}{30}$—gr. $\frac{1}{15}$.

Auri et Sodii Chloridum.—Chloride of gold and sodium. An orange-colored salt, crystallizing in four-sided prisms, soluble in water. Dose, gr. $\frac{1}{20}$—gr. $\frac{1}{10}$.

ANTAGONISTS AND INCOMPATIBLES.—Eggs, albumen, milk, flour, are chemical antidotes. The contents of the stomach should, of course, be evacuated. The principles of treatment are the same as for poisoning by corrosive sublimate.

SYNERGISTS.—The salts of mercury, especially the corrosive chloride, are very similar in action to the chlorides of gold, and are therefore synergistic.

PHYSIOLOGICAL ACTIONS.—The chloride of gold is a caustic in its local action. In toxic dose it excites violent gastro-enteritis, accompanied by such nervous phenomena as cramps, convulsive trembling, insomnia, priapism, insensibility, etc. In small medicinal doses these auric preparations promote the appetite and the digestive capacity. If long continued, especially if the dose be a full medicinal one, epigastric pain and distress are excited, nausea is induced, and loss of appetite follows. Constipation is usually produced by the preparations of gold, and this, notwithstanding an increased secretion of the intestinal glandular apparatus is one of the results of their administration. These preparations do not probably entirely enter the blood from the stomach, but part passes to the intestinal canal, is there decomposed, and is absorbed as oxide in combination with albumen. This is, however, conjectural. They are readily soluble and are very diffusible substances. What particular influence they exert on the composition and function of the blood, is at present quite unknown. A form of fever, known as *auric fever*, is caused by their prolonged administration. This fever is accompanied by profuse sweats, a very abundant flow of urine, and increased salivary secretion. The salivation caused by the preparations of gold differs from the mercurial in that there is no tenderness nor ulceration of the gums.

Peculiar effects on the mental state are produced by the administration of the auric preparations. The functions of the mind become more active, and even excited, and a state of cheerfulness is induced. In men marked aphrodisiac effects are produced, and the erections are often painful; in women increased venereal desires, and augmentation of the menstrual flow, are observed.

The elimination of the auric preparations takes place by the liver, the intestinal canal, but chiefly by the kidneys. The urine assumes a bright yellow color.

Prolonged administration of medicinal doses induces epigastric heat and oppression, headache, dryness of the throat and mouth, gastro-intestinal irritation, fever.

THERAPY.—The chloride of gold and sodium in small doses ($\frac{1}{20}$ grain), three times a day, will relieve *nervous dyspepsia. A red and glazed tongue, epigastric pain, increased by taking food, and a tendency to relaxation of the bowels after eating*, are indications for the use of this salt. *Catarrh of the duodenum, catarrh of the bile-ducts, jaundice*, are symptoms which may usually be removed by the salts of gold.

These preparations are employed chiefly in the treatment of *syphilis, secondary and tertiary.* They are indicated in the same cases in which corrosive sublimate is found effective. According to the author's experience, they are especially adapted to old cases in which a protracted mercurial course and the large use of the iodide of potassium have failed to remove long-standing tertiary symptoms. He has found them very serviceable in recurring *syphilitic ulcerations of the throat, syphilitic ozœna, syphiloma of bones, syphilitic phthisis*, etc.

Amenorrhœa, dependent on torpor of the ovaries, may be removed by the persistent use of auric preparations. *Chronic metritis*, with scanty menstruation, is often remarkably benefited by them. *Sterility*, dependent on these states, or due to coldness, is more certainly cured by these agents than by any other merely medicinal means. It is said by Martini that the tendency to *habitual abortion* may be averted by the use of chloride of gold. This authority has also found that *dropsy of the ovary* may be sometimes cured by the same agent.

Decline of the sexual power in man may be prevented by the use of gold salts. The following are symptoms which may be removed by these preparations: *diurnal seminal losses, weak and inefficient erections, inability for the sexual congress, due to irritability of the sexual organs.* They increase the frequency of the nocturnal losses in those who are suffering from plethora of these organs. Cases that are benefited by the bromide of potassium are increased by the chloride of gold, and *vice versa.*

The author calls especial attention to the use of the salts of gold in *chronic Bright's disease*, granular and fibroid kidney, and the so-called *depurative disease.* He has observed remarkable improvement to follow the persistent use of the chlorides of gold in these affections. They are best given in pill-form, and in small doses, $\frac{1}{20}$ — $\frac{1}{30}$ of a grain three times a day. It need hardly be mentioned that these preparations are not adapted to the acute forms of Bright's disease.

Excellent results are obtained from the use of these auric preparations in certain forms of mental disorder: e. g., *melancholia, hypochondria,* and allied mental states, accompanied by depression. *Vertigo* and *vertiginous sensations*, when due to stomach-disorders, are often removed by minute doses of the chlorides of gold, but plethora and increased intracranial blood-pressure contraindicate their use; on the other hand, they have a high degree of utility when there is present the condition of cerebral anæmia.

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Argentum.—Silver. *Argent*, Fr.; *Silber*, Ger.

Argenti Oxidum.—Oxide of silver. An olive-brown powder, very slightly soluble in water. Dose, gr. ss—grs. ij, in pill.

Argenti Nitras.—Nitrate of silver. A heavy, colorless, anhydrous salt, wholly soluble in distilled water, and crystallizing in shining, rhombic plates. Dose, gr. $\frac{1}{4}$—gr. ss, in pill, or in solution.

Argenti Nitras Fusa.—Fused nitrate of silver. In cylindrical pieces. Is only used for topical applications. Mitigated nitrate contains two, three, three and one-half, and four, parts of nitrate of potassa to one of nitrate of silver.

Argenti Cyanidum.—Cyanide of silver. Is a white powder, insoluble in water.

Antagonists and Incompatibles.—The soluble chlorides and all substances containing them are incompatible with the nitrate of silver; hence most of the natural waters decompose it, because they contain more or less common salt. An insoluble chloride of silver is the result of the decomposition. The following mineral acids, and their salts, are chemically incompatible: Sulphuric, muriatic, tartaric, and sulphurous. Alkalies and their carbonates, astringent infusions, and lime-water are incompatible. In cases of poisoning by nitrate of silver, common salt is the appropriate antidote. This should be given in solution very freely, to act as an emetic as well as chemical antidote.

Therapeutically the salts of silver are antagonized by all those agents which promote constructive metamorphosis.

Synergists.—All agents promoting waste, as mercury, iodides, etc., favor the action, therapeutically, of nitrate of silver.

Physiological Actions.—Nitrate of silver acts chemically on the tissues to which it is applied. It combines with the albumen, and excites a superficial inflammation, producing in some subjects vesication, in all a whitish eschar. It is, therefore, an escharotic, but of very limited activity. The white eschar produced by it, subsequently—under the influence of light—becomes brownish-black.

Nitrate of silver has a strong metallic, styptic taste. A strong solution, brushed over the mucous membrane, whitens it. In the stomach, the salts of silver produce a sense of warmth at the epigastrium, and, in large (toxic) doses, excite a violent gastro-enteritis. Meeting in the stomach soluble chlorides, undoubtedly the insoluble chloride of silver is formed, but a portion of the salt, probably, at once enters into combination with albumen and peptones. That the action of nitrate of silver, when swallowed, is not that of the chloride has been experimentally shown; hence the conversion of the nitrate salt into chloride does not suffice to explain the effects which ensue. Increased secretion from the intestinal glandular apparatus is produced by the silver salts, and the alvine dejections are softer and more frequent. Long-continued use of these agents will cause gastro-intestinal catarrh.

The salts of silver most probably enter the blood as albuminates and peptonates. They effect very important changes in the blood, which becomes darker and more fluid, the red corpuscles paler and altered in outline, the hæmoglobine converted into hæmatine. A slight lowering of the temperature is a result of these changes in the composition of the blood. Various tissues of the body undergo pathological alterations. The epithelium of the intestinal mucous membrane, of the kidneys and liver, becomes swollen and cloudy, and sometimes fatty. The amount of bile is increased, and albumen frequently appears in the urine. The nutrition of the body is impaired, and a progressive diminution in weight and strength takes place. The venous system is found in a state of stasis; transudations take place, the action of the heart is rapid and irregular, and the respiration is embarrassed.

The nervous system participates in the general impairment of structure; tetanic convulsions, paralysis, and insensibility, ensue. The paralysis is not due to alterations in the muscular system—for the muscles preserve their irritability—but is centric in origin. It is true the muscles, in poisoning by silver, become granular and their striæ obliterated, but their contractility is not destroyed.

Only a minute part of the silver administered is eliminated by the kidneys; most of it escapes by the liver and the intestinal glands; but a portion remains permanently deposited in the tissues if its administration has been protracted. Rarely is it safe to continue the use of the preparations of silver longer than six weeks, and occasional purgatives should be given to promote elimination. An olive, slate-colored, or grayish-brown discoloration of the various tissues of the body results from a deposition of silver. This is usually first seen at the margin of the teeth, or on the inside of the lips and cheeks, and is an indication that the system is becoming saturated. I find in Sieveking, "On Epilepsy," the following instructive instance of argyria: "The patient, a man aged sixty, became epileptic in March, 1856, and was treated with nitrate of silver almost from the commencement; for nine months he took a daily pill containing six grains, so that, during that time, he swallowed nearly three and a half ounces. Toward the end of July the skin began to be discolored, but, in spite of gastric symptoms, the remedy was persevered in. In 1857 hæmatemesis and other symptoms of gastric ulceration supervened, while the severity of the epilepsy had abated, and, having in the mean time come to England, he was admitted to the German Hospital, where he soon died. The special interest attaching to the autopsy is connected with the extent to which the silver had been deposited in the tissues. The parts in the face which had exhibited the greatest intensity of discoloration, owing to their containing more blood, now presented a tint uniform with the rest. In the brain the choroid plexuses presented a uniform grayish-blue tint. The lungs were tuberculous and pneumonic, the heart hypertrophic. The stomach contained a large quantity of acid, brown liquid streaked with blood, and at the upper part of the posterior wall was a large ulcer, at the base of which was an orifice blocked up by the adherent pancreas. The mucous membrane of the duodenum and jejunum was dotted over with many small black granules, most closely aggregated along the folds. In the ilium these spots become more and more scanty. . . . The spleen was small, its veins had an ashen hue, which was due to a finely-granular precipitate upon their coats. The liver was small, congested, and fatty; the small branches of the vena portæ, and of the hepatic veins, presented the same precipitate of silver throughout, but the capillaries were free from it. Fine sections of the hepatic tissue showed numerous black dots, each of which occupied the centre of an acinus, corresponding to the point of exit of a central vein, and the color was produced by a black margin surrounding the calibre of the artery. The largest argentine deposit was in the kidneys. . . . The pyramids all exhibited a dark-gray color, which was deepest, and all but black, near the papillæ. The tubules in these parts were entirely invested with a dense precipitate. . . . Parts of the skin taken from the temporal, axillary, and digital regions, were examined. Transverse sections showed a pale, purplish streak immediately underneath the rete Malpighii, following the undulations of the cutis. . . . The glandular epithelium uniformly presented fatty degeneration."

A persistent and long-continued use of the iodide of potassium and of the hyposulphite of soda has, in a few fortunate instances, caused the absorption and excretion of the silver deposits. The action of these systemic remedies for the discoloration may be aided by baths of the hyposulphites and by the cautious use of lotions containing the cyanide of potassium, which possess a decided solvent power over the silver deposits.

THERAPY.—The oxide and the nitrate of silver are extremely serviceable remedies in the so-called *nervous dyspepsia*, and in *chronic gastric catarrh.* They are indicated in the following state of things: Pain after taking food, lasting for an hour or more (gastralgia), the digestion, although slow, being good; burning pain, with pyrosis, coming on after the completion of the stage of stomach digestion; eructations of food, with sour and acrid matters—the first being a gastralgia, and the other states being caused by gastric catarrh, and consequent fermentation of the starch, sugar, and fats. ℞. Argenti oxidi, grs. v; ext. hyoscyami, grs. v. M. ft. pil. no. x. Sig. One three times a day before meals. In *chronic gastric catarrh*, Frerichs recommends the following formula: ℞. Argenti nitrat., grs. xv; aq. destil., q. s.; ext. belladonnæ, grs. x; ol. caryophylli, gtt. x; rad. gentian pulv., ext. gentianæ, āā q. s. ut ft. pil. no. lx. Sig. One pill three times a day. When there is much pain present, Wilson Fox highly commends the combination of nitrate of silver and opium in chronic gastric catarrh, but, as constipation so frequently attends this state, belladonna or hyoscyamus is usually to be preferred. Notwithstanding the strong opinion which Brinton has given adversely to the use of the salts of silver in *ulcer of the stomach*, the author agrees with Fox that these agents are, in this affection, next in value to bismuth. The oxide, or the nitrate, may be given in pill form, as above, or the nitrate in solution. In these stomach-affections, as a rule, the oxide of silver—being free from the causticity of the nitrate—is preferable.

In *jaundice dependent on catarrh of the biliary ducts*, especially when there are present considerable pain and stomach-disorder, the salts of silver not only give relief to some of the more distressing symptoms, but assist materially in restoring the functional activity of the liver. As respects these hepatic disorders, silver has an action similar to arsenic, manganese, mercury, and some other mineral remedies.

Frequently nitrate of silver is remarkably beneficial in *cholera infantum*, after the acuter symptoms have subsided. The following is an excellent formula for a child a year old: ℞. Argenti nitrat., gr. j; acid. nitric. dil., m. viij; tinct. opii deod., m. viij; mucil. acaciæ, ℥ ss; syrup. simplicis, ℥ ss; aquæ cinnamomi, ℥ j. M. Sig. A teaspoonful every three, four, or six hours. The nitrate of silver is also an efficient remedy in that form of *diarrhœa in children* in which the stools are white, pasty, and offensive, and the urine is high-colored and acrid. In *dysentery*, both of children and adults, after the acute symptoms have ceased, and in *chronic dysentery*, the nitrate of silver is a most efficient remedy. In some epidemics of *acute dysentery*, when the constitutional condition is one of depression, it is equally effective. In these maladies it is better to prescribe the nitrate in pill form (gr. ¼—gr. j) combined with opium. With the stomach administration of the nitrate may be conjoined its local application to the rectal mucous membrane, and even in favorable instances to the descending colon. In using nitrate of silver by enema, the application, to be effective, should be made through a flexible tube passed cautiously to the sigmoid flexure or beyond. The bowel, previous to the introduction of the silver solution, should be as thoroughly washed out as possible by tepid water. From ten to twenty grains of the nitrate of silver, to a pint of water, is a suitable proportion for an enema.

Obstinate *dysenteric discharges*, either alone or mixed with healthy-formed fæces, are not unfrequently caused by an *ulcer of the rectum*. The most effective treatment for such an ulcer consists in the application to it, through a suitable speculum, of the solid stick of nitrate of silver.

The author's experience justifies him in asserting that the most effective remedy for the *diarrhœa of phthisis* is nitrate of silver, combined with opium. When the *diarrhœa of typhoid fever* resists bismuth, Hope's mixture, and laudanum enemata, a satisfactory result may often be obtained by nitrate of silver, as follows: ℞. Argenti nitrat., grs. iij; pulv. opii, pulv. ipecac., āā grs. vj. M. ft. pil. no. xij. Sig. One every four or six hours. The nitrate of silver is one of the numerous remedies which have been used in the treatment of *cholera*.

Formerly nitrate of silver was much employed in the treatment of *epilepsy*, but it has justly fallen into disuse, for, besides the danger of tinting the skin, it is not as effective as much less objectionable remedies. Successful cases have been reported, it is true, but such judicious authors as Russell Reynolds and Sieveking condemn the treatment of epilepsy by nitrate of silver. Since proposed by Wunderlich, this agent has been fairly tested in the treatment of *posterior spinal sclerosis* (progressive locomotor ataxia), but the results have not justified the sanguine expectations of its utility entertained by its proposer.

Local Uses.—Nitrate of silver is largely used as an external application. A case has recently been reported in which argyriasis was produced by the free application of this salt to the fauces, hence some care should be exercised in applying it to the mucous membranes. For external use, the cylinder and solutions of various strengths are employed. The "mitigated" stick is used chiefly by ophthalmologists. The most satisfactory solution for local application to the skin is obtained by dissolving the salt in nitrous ether (grs. v—℈j—℥j of ether). This solution acts more energetically than the aqueous solution, and will readily vesicate.

Solutions of nitrate of silver are much less frequently applied than formerly to *inflamed tonsils*, *diphtheritic affections of fauces*, *acute laryngeal troubles*, *œdema of the glottis*, etc. In the incipiency of tonsillitis, a strong solution (℈j—ʒj—℥j) may sometimes avert the attack, but if the inflammation be well established the irritant action of the caustic increases the morbid process. The most enlightened modern authorities (Oertel) condemn the use of caustics in diphtheria; forcible detachment of the exudation only increases the chances of systemic infection, and injury done to the surrounding healthy mucous membrane invites the extension of the false membrane. A sufficient quantity of silver solution, to be effective, cannot be applied to the larynx, nor even to the aryteno-epiglottidean folds, without the aid of the mirror, and this manipulation is hardly available when a state of acute inflammation exists. *Follicular pharyngitis* is one of the affections which can be successfully treated by systematic local applications of silver solution. *Catarrh and ulceration of the posterior nares* may be cured by persistent use of the same remedy, the application being made by a suitable sponge probang, or brush, passed behind the veil of the palate. The appropriate strength for these purposes will depend, in part, on habit (grs. v—℈j—℥j). Very weak solution of nitrate of silver (gr. j—℥j) is sometimes used by the spray-douche (glass tube) in *chronic inflammation of the pharynx*, *larynx*, *and trachea*. Besides the ineffectiveness of this method, it is objectionable because the silver spray stains the face and clothing of the patient, unless a shield is very carefully used. To *ulcers of the tonsils*, *tongue*, *syphilitic and otherwise*, the solid nitrate is often used. It is a very painful application, and possesses but slight, if any, advantages over carbolic acid, which is anæsthetic after the first contact.

A strong solution of nitrate of silver, especially in nitrous ether, is a most efficient application to check inflammation in superficial parts, e. g., *boils*, *felon* (paronychia), *thecal abscess*, *orchitis*, *synovitis*, etc. It is essential to the success of this treatment that the application be made early. According to the method of Mr. Furneaux Jordan, it is better to make these applications to the adjacent "vascular territory," than to the inflamed part directly. To illustrate: In the case of orchitis, instead of painting the silver solution over the testicle, it is better to apply it along the groin and inner face of the thigh, over the course of the great vessels.

Mr. Higginbottom, who is the author of this method of treatment, says that "we have no therapeutic agent so safe, powerful, or efficacious, as the nitrate of silver in subduing external inflammation when properly applied. It has been invariably successful in my hands for nearly the last forty years." Such unstinted praise from so eminent an authority deserves our most respectful consideration. As the proper application of the remedy is so important, it were better to follow literally the method of Mr. Higginbottom: "The affected part should be well washed with soap-and-water, then with water alone, to remove every particle of soap, as the soap would decompose the nitrate of silver; then to be wiped dry with a soft towel. *The concentrated solution of four scruples of the nitrate of silver to four drachms of distilled water is then to be applied two or three times on the inflamed surface and beyond it, on the healthy skin, to the extent of two or three inches.* The solution may be applied with a small piece of clean linen, attached to the end of a short stick; the linen to be renewed at each subsequent application. . . . In about twelve hours it will be seen whether the solution has been well applied. If any inflamed part be unaffected, the solution must be immediately reapplied."

The method of Mr. Higginbottom is extremely effective in *traumatic erysipelas.* The common *facial erysipelas* rarely requires any thing but the simplest application. The concentrated solution of nitrate of silver should be thoroughly applied to *malignant carbuncle of the lip*, and to the adjacent healthy skin for a short distance. The *pitting of small-pox* may be prevented by rupturing each pustule and inserting into it a sharply-pointed pencil of the nitrate of silver. According to Mr. Higginbottom, the same result may be accomplished, and with greatly less labor, by applying his solution in the manner above indicated.

The solution of nitrate of silver in nitric ether (℈ij—℥j) is recommended by Fox in the chronic forms of *erythema*, *eczema*, *psoriasis*, and *ringworms. Indolent ulcers*, *discharging sores with flabby granulations*, are improved in character, and made to heal by application of Higginbottom's concentrated solution, or of solid caustic.

Ulceration of the cervix uteri, *endo-cervicitis*, *granular cervicitis*, *endo-metritis*, are effectively treated by nitrate-of-silver applications. The solid caustic may be quickly brushed over the mucous membrane, or a concentrated solution may be applied with a suitable "applicator." There is no doubt that solid caustic may be applied with safety in chronic cases to the interior of the uterine cavity, after preliminary dilatation of the cervical canal. This is a most effective treatment, but injury is often done by over-stimulation and too-prolonged contact of the caustic. Induration of the cervix and narrowing of the cervical canal are sometimes produced by injudicious use of the solid caustic. That troublesome affection, *pruritus of the vulva*, may often be removed, even when due to pregnancy, by washing the neck, and the cervical canal so far as it is accessible, with a strong solution of the nitrate of silver (℈j—℥j). When the pruritus is due to a vesicular eruption on the genitals, the application should be made to the affected part. *Gonorrhœa* (vaginal) of the female is most quickly removed by applying through the speculum, and to every part of the canal, a concentrated solution of silver nitrate (℈j—ʒj). In the male, *gonorrhœa*, at its first appearance, may sometimes be aborted by a strong injection (ʒj—℥j), but unfortunately the period is usually past when this violent practice may be advised. Weak solutions (gr. j—grs. v—℥j) are, as a rule, more efficient, as they are unquestionably safer. *Cauterization of the prostatic part* of the urethra was at one time vulgarized in the treatment of *spermatorrhœa* by the influence of Lallemand, but this dangerous practice is rarely necessary. The author coincides with Mr. Furneaux Jordan in the expression of the belief that a vesicating solution of nitrate of silver applied to the perinæum is as generally useful, and, of course, entirely without danger.

Solutions of nitrate of silver are much used in ophthalmic and aural surgery. To *granular lids*, a strong solution (℈j—℥j) is applied; to *acute conjunctivitis*, a weak solution (gr. j—grs. iv—℥j); but generally ophthalmologists prefer the zinc and copper salts in the treatment of these affections. The incautious use of silver salts, when there are corneal ulcers, may result in unsightly deposits and opacities. *Otorrhœa*, *eczema of the external auditory meatus*, and *chronic inflammation of the external ear*, may be cured by silver solutions properly applied. A commencing *furuncle* of the external canal may sometimes be aborted by application of Mr. Higginbottom's solution.

The stains made by nitrate of silver on fabrics or on the hands may be removed as follows: Moisten the spots and drop upon them a few drops of tincture of iodine, and wash with a solution of hyposulphite of soda (ʒss—℥j). These stains may also be removed by washing them with the following solution: Cyanide of potassium, ʒijss; iodine, grs. xv; water, ℥iij.

Besides the above-mentioned external applications of nitrate of silver, this salt is also used according to the method of Luton, entitled "parenchymatous substitution." This consists in injecting, with an hypodermic syringe, a few drops of a concentrated solution into the parenchyma of organs—an irritant injection. *Cystic tumors* (wens), *small fatty tumors*, *abscesses*, and *hydrocele*, may be cured by injecting five to ten drops of a strong solution (℈j—ʒij). In the case of cysts and hydrocele, the contents may be allowed to escape through the needle, and then the irritant solution be injected. More or less active inflammation follows, and the sac, after a variable stage of suppuration, becomes entirely obliterated.

Old and intractable cases of *sciatica* that resist other means, including hypodermic injection of anodynes, are sometimes permanently relieved by injecting deeply into the neighborhood of the affected nerve ten to twenty drops of a solution of nitrate of silver. Suppuration usually follows, and the local inflammatory process terminates the previously-existing nerve-lesion (parenchymatous substitution).

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Cuprum.—Copper. *Cuivre*, Fr.; *Kupfer*, Ger.

Cupri Subacetas.—Subacetate of copper. Verdigris. "In masses of a pale-green color, almost wholly soluble in dilute sulphuric acid, with the aid of heat. Ammonia added to the solution produces a precipitate, which is entirely dissolved by an excess of the alkali."

Cupri Sulphas.—Sulphate of copper. Blue vitriol. "In blue crystals, slightly efflorescent in the air, and entirely soluble in water. Ammonia throws down from the solution a precipitate, which is wholly dissolved when the alkali is added in excess." Dose, gr. ⅛—gr. ss.

Cuprum Ammoniatum.—Ammoniated copper. A deep, azure-blue powder, having an ammoniacal odor, and a styptic, metallic taste. It is soluble in water. Dose, gr. ⅛—gr. j.

ANTAGONISTS AND INCOMPATIBLES.—Alkalies and their carbonates, lime-water, mineral salts (except the sulphates), iodides, and most astringent vegetables, are chemically incompatible with the salts of copper. In cases of poisoning, white of eggs and milk should be given freely, but evacuation of the contents of the stomach is necessary, for the albuminate of copper is not devoid of toxic power. The most effective chemical antidote is said to be the ferro-cyanide of potassium, forming the insoluble ferro-cyanide of copper. Magnesia has also been proposed, but it should not be relied on to the exclusion of albumen and ferro-cyanide of potassium, nor should any antidote be used without evacuating the stomach contents by emetics or the stomach-pump.

Synergists.—The salts of lead, tin, zinc, mercury, silver, gold, favor the therapeutic action of the copper-salts. All of these agents agree in this; they promote waste, and affect the functions of the nervous system secondarily. All unfavorable hygienic conditions, which depress the functions of the body, increase the activity of the copper-salts.

Physiological Actions.—The salts of copper have a styptic, metallic taste. When a poisonous dose of a copper-salt has been taken the following symptoms, referable to the digestive organs, appear: A strong metallic taste, burning and constriction of the throat, increased flow of saliva, burning pain at the epigastrium, with griping and colic-pain of the intestines, nausea and vomiting. The vomited matters have usually a bluish or greenish color, and the intestinal evacuations, which begin in a few minutes after the poison has been swallowed, are dark-greenish and frequently bloody. These are the symptoms produced by the irritant poisons, and have no special characters, except, it may be, the *color* of the evacuations. The salts of copper, being diffusible substances, quickly enter the blood, and the systemic symptoms which follow are referable to the nervous system and the organs of excretion. In the blood, as is the case with the other metallic poisons, copper probably exists in the form of an albuminate in close relation to the red blood-globules. The breathing becomes short, hurried, and labored; the pulse small, quick, and weak; the skin cold and perspiring, and restlessness, headache, trembling, cramps, vertigo, and stupor, are followed by convulsions (clonic or tetanic), paralysis, and insensibility.

Inhalation of cupreous fumes, as in certain occupations in the arts, the slow introduction of small quantities, as occurs sometimes from cooking acid fruits in copper vessels, or the prolonged medicinal administration of moderate doses of a copper-salt, will produce the symptoms of chronic or slow poisoning. When inhaled, the symptoms first observed are those of bronchial irritation and bronchial catarrh (Hirt). Internally administered, a gastro-intestinal catarrh is produced, epigastric pain is experienced, nausea, vomiting, colic, tenesmus, and dysenteric discharges, and complete anorexia occur. The loss of appetite, and the interference with digestion, as well as the injury done to the red blood-globules, impair the strength and increase the waste of the tissues. A purplish line along the margin of the gum has been observed, salivation and ulceration of the gums not unfrequently occur, and occasionally jaundice is present as one of the symptoms. As regards the nervous system, headache, muscular trembling, paresis of the limbs, and sometimes paralysis, altered sensations, defects of coördination, impaired mind, result. These nervous symptoms, with bronchial and gastro-intestinal catarrh, are usually grouped together in the case of chronic cupreous poisoning in artisans.

Copper is eliminated by the liver, intestinal canal, salivary glands, and kidneys. As is the case with the other metallic poisons, copper tends to accumulate in the liver.

THERAPY.—The sulphate of copper is one of the remedies sometimes effective in the *vomiting of pregnancy*. For this purpose not more than one-twentieth of a grain, three times a day, is admissible. ℞. Cupri sulphat., grs. ij; aquæ destil., ℥ ss. M. Sig. Six drops a dose.

As sulphate of copper is a very prompt and effective emetic, it is frequently resorted to in cases of *narcotic poisoning*. ℞. Cupri sulphat., grs. vi; aquæ destil., ℥ ij. M. Sig. *A tablespoonful every fifteen minutes until vomiting ensue.* It may be used under the same circumstances, but is by no means so desirable *an emetic, in croup*, as subsulphate of mercury. Minute doses of sulphate of copper render excellent service in *gastro-intestinal catarrh*, especially when the bowels are relaxed. ℞. Cupri sulphat., gr. j; ext. nucis vom., grs. iv. M. ft. pil. no. xvj. One three times a day before meals. When the food taken gives rise to colic, which is quickly followed by the inclination to stool, there should be combined with the above prescription one grain of morphium sulphate. When constipation coexists with intestinal catarrh, the following prescription is useful: ℞. Cupri sulphat., gr. j; ext. physotigmatis, ext. belladonnæ, ext. nucis vom., āā grs. iv. Ft. pil. no. xvj. Sig. One pill, three times a day, before meals.

The sulphate of copper is a most useful remedy in *acute dysentery*. ℞. Cupri sulph., gr. ss; magnesiæ sulph., ℥ j; acid sulph. dil., ʒ j; aquæ, ℥ iv. M. Sig. A tablespoonful every four hours. After the acuter symptoms have subsided, the sulphate of copper may be given with morphia and opium. Of all the metallic astringents employed for this purpose, sulphate of copper is the most effective in *chronic diarrhœa* and *chronic dysentery*. ℞. Cupri sulphat., gr. j; morphiæ sulph. gr. j; quiniæ sulph., grs. xxiv. M. ft. pil. no. xij. Sig. *One pill three times a day.* Sulphate of copper is indicated when there are present colic-pains, tenesmus, and the stools, partly feculent, contain mucus streaked with blood. When *tolerance* is established, the quantity of copper in the above formulæ may be increased slowly to one-fourth of a grain. Rarely can more than one-twelfth of a grain be given to an adult unaccustomed to its use, without causing very unpleasant nausea and depression.

The *dysentery and cholera infantum* of children, and the *chronic entero-colitis* which sometimes succeeds to measles, are often remarkably benefited by minute doses of sulphate of copper. ℞. Cupri sulphat., gr. j; tinct. opii deodor., gtt. viij; aquæ destil., ℥ iv. M. Sig. *A teaspoonful every two, three, or four hours*, for a child from one to two years of age.

The sulphate of copper is a useful palliative astringent in the *diarrhœa of phthisis.* It should be combined with opium.

Kissel regards the salts of copper as curative in *pneumonia*, and the preparation which he prefers is the tincture of the acetate (Phar. Ger.). The mortality under this treatment was only 4.3 per cent. Rademacher and his followers have based a large part of their therapeutical system on the uses of copper.

The salts of copper, especially the *cuprum ammoniatum*, are among the numerous remedies employed in the treatment of *epilepsy*, *chorea*, and *hysteria*. Successful results have, it is true, been obtained by the use of these remedies, but at the present time they are rarely employed.

External Uses.—The salts of copper do not act very energetically on the unbroken integument. Applied to wounds they are astringent —that is, they combine with albumen, contract the tissues, and coagulate the blood. A crystal of sulphate of copper may be used *to arrest bleeding from small wounds*, e. g., from *leech-bites*. *Indolent ulcers with flabby granulations* can be stimulated to a renewed and more healthy activity by touching the affected surface with a crystal of sulphate of copper, or by frequent application of a solution (grs. ij—grs. x—℥j). The following is an excellent injection in *gonorrhœa* after the acute stage: ℞. Cupri sulph., grs. iv; morphiæ sulph., grs. viij; liq. plumbi subacetat., ʒj; aquæ rosæ, ℥iv. M. Sig. *As an injection.* In that troublesome affection *granular lids*, the sulphate of copper may be rubbed over the everted lid once a day with advantage. The application gives great pain, and is immediately followed by intense hyperæmia, which, however, subsides in a few hours, leaving the conjunctiva in much better condition than before.

In *scabies*, a solution of sulphate of copper (℥j—Oj) has been used with great success, the lotion being applied after the crusts have been thoroughly removed with soap and water. An ointment of acetate of copper (grs. x—℥j) is a very effective application in *herpes circinatus* (ringworm). The following formula has been recommended in *mentagra:* ℞. Cupri sulph., ʒj; zinci sulph., ℥ss; aquæ laur.-cerasi, ℥jss; aquæ destil. ad ℥xvj. M. Sig. *Lotion.* The acetate and carbonate of copper are very effective remedies in *tinea sycosis.* ℞. Cupri carb., ʒij; adipis, ℥j. M.

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Plumbum.—Lead. *Plomb*, Fr.; *Blei*, Ger.

Plumbi Oxidum.—Oxide of lead. Litharge. "In small yellowish or orange-colored scales, insoluble in water, but almost wholly soluble, with slight effervescence, in dilute nitric acid. The solution is affected by potassa, like that of carbonate of lead in the same acid."

Emplastrum Plumbi.—Lead-plaster. Litharge and olive-oil.

Plumbi Acetas.—Acetate of lead. Sugar of lead. "In colorless crystals which effloresce on exposure to the air. It is dissolved by distilled water, with a slight turbidness, which is removed by the addition of vinegar. With this solution carbonate of sodium produces a white, iodide of potassium a yellow, and hydrosulphuric acid a black precipitate. Upon the addition of sulphuric acid vapor is evolved, having the smell of vinegar." Dose, gr. ss—grs. v.

Liquor Plumbi Subacetatis.—Solution of subacetate of lead. "A colorless liquid of the specific gravity of 1.267. It is decomposed by exposure to the air, carbonate of lead being formed. When added to a solution of gum it occasions a dense white precipitate."

Liquor Plumbi Subacetatis Dilutus.—Diluted solution of subacetate of lead. (Solution of subacetate, ʒ iij; distilled water, Oj.)

Ceratum Plumbi Subacetatis.—Cerate of subacetate of lead.

Plumbi Carbonas.—Carbonate of lead. "A white substance in powder or pulverulent masses, insoluble in water, but soluble, with effervescence, in dilute nitric acid. Potassa added to the solution produces a white precipitate, which is wholly dissolved by an excess of the alkali. Heat renders it yellow, and, with the aid of charcoal, reduces it to the metallic state."

Unguentum Plumbi Carbonatis.—Ointment of carbonate of lead. (Carbonate, ʒ j; ointment, ʒ vij.)

Plumbi Nitras.—Nitrate of lead. "In white, nearly opaque, octahedral crystals, permanent in the air, and of a sweet astringent taste. It is soluble in seven and a half parts of cold water, and in alcohol. Its solution is precipitated black by hydrosulphate of ammonium, white by ferrocyanide of potassium, and yellow by iodide of potassium."

Plumbi Iodidum.—Iodide of lead. "A bright-yellow, heavy, inodorous powder, fusible and volatilizable by heat, and soluble in twelve hundred and thirty-five parts of cold, and one hundred and ninety-four parts of boiling water. A hot saturated solution, on cooling, deposits the salt in brilliant, golden scales."

Unguentum Plumbi Iodidum.—Ointment of iodide of lead. (Iodide of lead, ʒ j; ointment, ʒ vij.)

Antagonists and Incompatibles.—Natural waters containing lime, sulphates, carbonates, carbonic acid, mineral acids and mineral salts, vegetable acids, alkalies, iodide of potassium, the vegetable astringents in general, albuminous solutions, and the preparations of opium, are incompatible. In cases of poisoning by acetate of lead, the proper antidotes are the sulphates of soda or magnesia, phosphate of soda, milk, and albuminous solutions. Emetics and the stomach-pump should be used.

SYNERGISTS.—Cold, digitalis, ergot, veratrum viride, and agents acting similarly, favor the influence of acetate of lead over the circulatory system. Copper, mercury, antimony, and remedies promoting waste, increase the depressing effects of lead on the nutrition of the body.

PHYSIOLOGICAL ACTIONS.—The acetate is astringent; that is, it combines with albumen to form compounds, for the most part insoluble in water and in acids. All the salts of lead are more or less toxic. As the acetate, which is most frequently the preparation taken, has a sweetish taste, mistakes not unfrequently happen; but the after-taste is decidedly astringent and slightly metallic. As the combination of the salts of lead with albumen takes place on contact, this action ensues in the mouth in part, and is completed in the stomach. Any part of the lead reaching the intestinal canal must be converted into the insoluble sulphide. A very large quantity of the acetate of lead is required to produce a fatal effect; not less than an ounce. When swallowed in this quantity and retained, it produces intense gastric irritation, sometimes choleriform symptoms, numbness, paralysis, coma, collapse. Owing to the fact that so large a quantity of acetate of lead will be rejected by vomiting, cases of acute poisoning rarely terminate fatally, and are infrequent. On the other hand, chronic poisoning by lead is very common, owing to the use of cosmetics and hair-dyes containing lead, the use of food preserved in tin cans soldered with lead, and to the contamination of drinking water. Very rarely is the acetate of lead so persistently used in medical practice as to produce toxic symptoms.

When lead is slowly introduced into the organism in small doses, the first symptoms usually observed are loss of appetite, failure of strength, more or less wasting, paleness of the face and of the integument generally, and constipation. The joints become the seat of rheumatoid pain; there is dry colic, the pain of which is assuaged by pressure; and the muscles of the abdominal parietes are also seized with neuralgia. At the same time the liver diminishes in size, the abdominal fat disappears, the intestines are contracted, the belly is drawn in toward the spinal column. Coincidently with the contraction of the liver, the skin assumes an icteroid hue, the conjunctivæ become yellow, and the urine is tinged with the biliary coloring matters. At this time may be observed the so-called "blue line" along the margin of the incisor teeth—a slate-colored line, probably due to a deposition of the sulphide of lead, and found only, according to the author's experience, in those not accustomed to the use of a tooth-brush. The mucous membrane of the lips and mouth has often a bluish or slate-colored tint, and sometimes brownish pigment-deposits are seen on the lips near the teeth, and on the gums. Albuminuria may exist at this time, but it is commonly present further on in the history of these cases. Lead may cause that condition of hyperalbuminosis which eventuates in albuminous urine, but probably it in most cases hastens the development of changes in the kidneys already impending. As Garrod has conclusively shown, the use of lead, or its slow introduction through unknown channels, hinders the conversion of uric acid into urea, and favors the deposition of urate of soda about the joints: hence the arthritic pains which accompany the other symptoms of chronic lead-poisoning, and the intimate dependence of the presence of lead in the organism and gouty attacks.

The symptoms thus far sketched are chiefly those due to the influence of the agent over the oxidation processes of the body in general. It is necessary now to consider the action of lead on the nervous system. Lead *gastralgia* is an early symptom, in part due to the fact that the metal acts directly on the nerves of the stomach, but it is also a symptom of the action of the poison on the central nervous system. Lead *arthralgia*, already referred to, is frequently an affection of the intra-muscular nerves, and has its seat more especially in the flexor muscles. The swelling of the joints and the joint-pains are doubtless due, as already explained, to the deposition of the urates in the joints themselves, but the term arthralgia is used to describe that form of pain about the joints produced by lead. Impaired sensibility to touch is also one of the phenomena of lead-poisoning. This *lead-anæsthesia* is found about the neck, chest, the forearms (their palmar face), hands, and fingers, and is symmetrically distributed on the two sides. Anæsthesia of the optic (*amaurosis*) is also a result of the direct action of lead, but dimness of vision and a sluggish pupil may also be due to the albuminuria which is so frequently present. *Paralysis* of the common extensors of the fingers and of the supinators, while the power of the flexors and pronators is much less diminished, constitutes that very striking symptom of lead-poisoning, "the drop-wrist." When the arms are raised the hands drop forward and to the palmar face of the forearm, from an inability of the extensors to hold them up. Paralysis may invade the laryngeal muscles, producing *aphonia*. Sometimes the paralysis has the hemiplegic form, and, still more rarely, the paraplegic. At the beginning of the paralysis, the muscular irritability is preserved, but it soon lessens, and is lost finally, so that the muscles cease to respond to the faradic current. For some time after the induction current fails to excite contraction, muscular movements may be obtained by a slowly-interrupted galvanic current.

Death may result from the saturnine cachexia, by the gradual failure of nutrition, and by the extension, finally, of the muscular paralysis to the muscles of respiration. Death may occur much earlier, by the development of those symptoms to which has been applied the term *lead-encephalopathy*—a form of disease characterized by delirium and convulsions, ending in fatal coma.

Lead is very fatal to the life of the fœtus, and women the subjects of the saturnine cachexia abort early, or produce stillborn children.

After death, lead is found in various organs of the body, and relatively in large amount in the brain. It is also largely deposited in the substance of the affected muscles and nerves, and the destruction of the Hallerian irritability, the disappearance of the striation and the granular condition of the nerves, are probably due to the direct action of the metal. Lead, also, like the other minerals, tends to accumulate in the liver; much of it is probably eliminated by the intestinal glands and skin, and some passes out by the kidneys.

The treatment of lead-poisoning is prophylactic and curative. Among the former are, personal cleanliness, frequent bathing, the use of sulphuric-acid lemonade, the habitual employment of milk in large quantity as a food, and the avoidance of all sources of contamination. Among the curative measures must be placed first, large doses of the iodide of potassium, purgative doses of Epsom salts, and sulphur-baths. The affected muscles should be early faradized to prevent atrophic changes. When they fail to respond to a faradic current, a slowly-interrupted galvanic current should be used, and after a time the faradic irritability may be recovered.

THERAPY.—Acetate of lead is one of the astringent remedies employed to arrest *hæmatemesis.* It is more especially adapted to the vomiting of blood, which accompanies *gastric ulcer.* This salt exercises a favorable influence over the course and progress of gastric ulcer; it allays pain and local inflammation, and modifies the ulcerated surface. In *chronic gastric catarrh* with *gastralgia* and *pyrosis*, it has given great relief. Notwithstanding the chemical incompatibility, it may be advantageously combined with morphia in painful stomach-affections. The most frequent use of the acetate of lead in gastro-intestinal disorders is in the treatment of the various forms of *diarrhœa.* It is an excellent remedy in the *summer diarrhœa of children.* ℞. Plumbi acetat., grs. viij; acid. acetic., gtts. vj; tinct. opii deodor., gtts. iv; aquæ destil., ℥j. M. Sig. A teaspoonful every two, three, or four hours for a child two years of age. In *choleraic diarrhœa,* acetate of lead is one of the most useful astringents: ℞. Plumbi acetat., grs. xxiv; pulv. opii, grs. xij; pulv. camphoræ, ʒss; sacch. alb. q. s. ft. pulv. no. xii. Sig. One powder every hour or two. It is sometimes preferable to administer the acetate of lead in solution, when the formula above given for children may be used in corresponding dose for adults. Probably, the most generally successful remedy for the *diarrhœa of phthisis* is a pill containing equal parts of acetate of lead and opium. The *diarrhœa of typhoid* may also be restrained by acetate of lead and opium; but generally bismuth is more suitable than acetate of lead. In *acute* and *chronic dysentery* lead is often a useful astringent. Enemata of lead and morphia (℞. Plumbi acetat., grs. iv; morphiæ acetat., gr. ss; aquæ fervid., ℥ j) allay the tenesmus of *acute dysentery*. Enemata of corresponding strength to age, of the same composition, are very useful in the *cholera infantum* of children.

Although the salts of lead undergo important chemical changes in the intestinal canal, and are probably very much modified in composition before they enter the blood, yet there is no doubt about their power to affect remote parts. The value of acetate of lead in various forms of *hæmorrhage* has been attested by an immense clinical experience. Thus, in *hæmoptysis*, it is a most useful hæmostatic. Careful observations on a case of severe and protracted pulmonary hæmorrhage demonstrated that five grains of the acetate, every three hours, exercised a remarkable influence over the arterial tension and the action of the heart. Its effects are similar to those of digitalis: it slows the action but increases the power of the heart, while at the same time it elevates the tension of the arterioles. The astringent is, however, a dynamical and not a chemical action, doubtless. There is, therefore, a fitness in the prescription of Oppolzer for *caseous pneumonia:* ℞. Inf. digitalis, ℥ iv; plumbi acetat., ℈ j; tinct. opii, ʒ j. M. Sig. A tablespoonful twice a day. A similar combination is serviceable in *hæmoptysis:* ℞. Plumbi acetat., ℈ ij; pulv. digitalis, ℈ j; pulv. opii, grs. x. M. ft. pil. no. xx. Sig. One every four hours.

By virtue of its astringent action acetate of lead restrains secretion, and hence its utility in *bronchorrhœa*. It is also serviceable in *humid asthma* and *whooping-cough*.

Formerly acetate of lead was used to quiet the action of the heart in *hypertrophy*, and to favor coagulation of the blood in the case of *internal aneurism*. It might often be usefully employed in these affections now.

In prescribing the preparations of lead for internal use, the danger of producing *plumbism* should not be overlooked. When it is used for any considerable period, the gums should be frequently inspected, and on the slightest appearance of a blue line, or on the occurrence of constipation and abdominal pain, the remedy should be at once discontinued.

External Application of Lead Preparations.—The uses of lead preparations for external diseases are numerous and important. An excellent application to *burns* is white-lead paint—carbonate of lead and linseed-oil. This may be objectionable when the surface is very large, lest a dangerous amount of absorption take place, but for burns of small extent it is safe and gives great relief. The surface of the burn is thickly coated with the paint. Lead-lotion (*liquor plumbi subacetatis dilutus*) is a good application to *eczema* when there is much weeping. The following ointment has been recommended in this affection: ℞. Plumbi acetat., ℥ ss; camphor. pulv., grs. xv; ol. amygdal., ℥ ij; ceræ flavæ, ℥ j. M. ft. cerat. An excellent formula for *eczema*, when there are great heat and redness, and profuse discharge, consists of liquor plumbi subacetatis, ℥ j; glycerini, ℥ ss; and cherry-laurel water, ℥ iijss. The following formula is recommended by Fox in *eczema and lichen:* ℞. Acid. nitrici dil., ʒ ss; plumbi acetat., grs. v; aquæ, ℥ vj. M. In *erythema* the carbonate of lead is used with advantage: ℞. Plumbi carb., grs. iv; glycerini, ʒ j; cerat. simplicis, ℥ j. M. In *impetigo* the following: ℞. Plumbi acetat., grs. xv; acid. hydrocyan. dil., m. xx; alcoholis, ℥ ss; aquæ, ℥ vss. M.

Lead-lotions are much used to cure *muco-purulent and purulent discharges from the ear, the vagina, and the urethra.* They may be employed at any stage, and the existence of inflammation does not contraindicate their use. The following is a useful formula for *gonorrhœa:* ℞. Liq. plumbi subacetat. dil., ℥ iv; zinci sulphat., grs. viij. M. Sig. *As an injection.* A chemical change, of course, takes place, but clinical experience is in favor of the combination.

The ointment of the iodide of lead is often a useful application to *enlarged lymphatic glands* and to *enlarged spleen.* It is also employed with benefit in cases of *chronic eczema, porrigo,* and *psoriasis.*

A solution of the nitrate of lead in pure glycerine (grs. x—℥ j) is an effective application to *fissured nipples.* It need hardly be remarked that the nipple should be well washed before the child is permitted to suck. Nitrate of lead in form of powder, dusted over the unhealthy granulations, gives great relief, and hastens the healing of *onychia.*

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SECOND ANNUAL REPORT OF THE STATE BOARD OF HEALTH OF MASSACHUSETTS, 1871, p. 21.

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Zincum.—Zinc. *Zinc,* Fr.; *Zink,* Ger.

Zinci Oxidum.—Oxide of zinc. "A yellowish-white powder, insoluble in water, but soluble in dilute sulphuric and muriatic acids without effervescence. The solutions, when neutral, yield white precipitates with ferrocyanide of potassium and hydrosulphate of ammonium." Dose, gr. ss—grs. x.

Zinci Carbonas Precipitata.—Precipitated carbonate of zinc. A light, white powder, resembling magnesia in appearance.

Ceratum Zinci Carbonatis.—Cerate of carbonate of zinc. (Carbonate, ℥ ij; ointment, ℥ x.)

Zinci Sulphas.—Sulphate of zinc. "In colorless crystals, which effloresce on exposure to air. It is soluble in water, and the solution affords white precipitates with ammonia, chloride of barium, ferrocyanide of potassium, and hydrosulphate of ammonium. The precipitate thrown down by ammonia is wholly soluble in an excess of the alkali." Dose, gr. ¼—grs. vj.

Zinci Acetas.—Acetate of zinc. "In micaceous crystals, which effloresce in a dry atmosphere. It is very soluble in water, and its solution yields white precipitates with ferrocyanide of potassium and hydrosulphate of ammonium. The salt is decomposed by sulphuric acid, with the escape of acetous vapors." Dose, gr. ss—grs. ij.

Liquor Zinci Chloridi.—Solution of chloride of zinc.

Zinci Chloridi.—Chloride of zinc. "A white deliquescent salt, wholly soluble in water, alcohol, and ether. Its aqueous solution yields with nitrate of silver a white precipitate, insoluble in nitric acid." (These preparations are for external use only.)

Zinci Valerianas.—Valerianate of zinc. "A white anhydrous salt, in the form of pearly scales, having a faint odor of valerianic acid, and a metallic styptic taste. It dissolves in one hundred and sixty parts of water, and in sixty of alcohol of the specific gravity of 0.833."

Unguentum Zinci Oxidi.—Ointment of oxide of zinc. (Oxide of zinc, 80 grains; ointment of benzoin, 400 grains.)

Antagonists and Incompatibles.—Lime-water, the alkalies and their carbonates, nitrate of silver, and the vegetable astringents, are incompatible with zinc-salts. The acetate of lead is also incompatible, but a solution containing sulphate of zinc and acetate of lead, notwithstanding the double decomposition which ensues, is an effective injection in gonorrhœa. With valerianate of zinc, acids, many of the metallic salts, soluble carbonates, and vegetable astringents, are incompatible. The antagonists to be used in cases of poisoning by the zinc-salts are lime-water, mucilaginous drinks, milk, tannic acid, the carbonated alkalies, common soap, etc.

Synergists.—The mercurial, silver, antimonial, and copper preparations, favor the action of the zinc-salts.

Physiological Actions.—The preparations of zinc are active in proportion to their solubility and power of diffusion. The chloride, the sulphate, and the acetate, are the most active, and in the order in which they are placed; the carbonate and the oxide being insoluble, have very feeble diffusive power, and possess consequently very slight activity. The chloride is a very active escharotic. Applied to the denuded integument it sets up decided inflammation, and produces an intense burning pain, followed by sloughing. Owing to its great affinity for water and power of combination with albumen, it penetrates deeply and widely, and the eschar which it produces is thick, hard, and white. The dried sulphate of zinc (deprived of its water of crystallization by heat) is also feebly escharotic when applied to an open wound. Solutions of the sulphate and acetate act locally as *astringents* by combining with albumen.

The soluble salts of zinc have a styptic metallic taste, which is very disagreeable. The sulphate of zinc is a very prompt and efficient emetic, acting without much preliminary nausea, and without much constitutional depression. It is a *specific emetic;* it acts to produce emesis when injected into the veins. Long-continued use of the sulphate, even in small medicinal doses, may excite ulceration of the mucous membrane. The oxide and carbonate, although insoluble and inactive, slowly produce systemic effects. The chloride is a powerful irritant poison, causing heat and a sense of constriction of the throat, a strong metallic taste, burning at the stomach, nausea, vomiting, great depression of the pulse, coldness of the surface, cold-sweat, cramps of the legs, etc. The mind is unaffected. In a few instances nervous symptoms have followed, besides the cramps, and in one notable case there was loss of the senses of taste and smell.

All of the salts of zinc, when long continued, may produce a train of symptoms not unlike those caused by lead, viz., emaciation, pallor, loss of strength, constipation and colic, muscular weakness and trembling, paralysis, etc. The oxide in large doses, and used for a long period, has produced wasting, a fetid breath, gastro-intestinal catarrh, weakness, and feeble mind.

The zinc-salts most probably exist in the blood in the form of albuminate, and in close relation to the red blood-globules. They manifest much less tendency to accumulate, and are excreted much more rapidly than mercury, lead, and copper. They diffuse out of the blood chiefly by the liver and intestinal glandular apparatus, and are found in great quantity in the fæces. To a slight extent they are also excreted by the kidneys.

THERAPY.—The sulphate of zinc is much employed as an *emetic* in cases such as *narcotic poisoning*, where prompt and efficient action is necessary. Six grains will generally prove sufficient. It may be repeated every fifteen minutes, well diluted with water, until emesis occurs. It was formerly much employed as an *emetic* in *croup*, but now tartar-emetic, but especially the subsulphate of mercury, is preferred.

The oxide of zinc is an excellent remedy for *gastralgia*. It is indicated also in the following state of things: *pain after taking food, nausea, intestinal pain, succeeded by prompt alvine discharges*, the fæces being made up largely of undigested food. From five to ten grains mixed with aromatic powder and combined with morphia, if need be, may be given before each meal. In the *summer diarrhœa of children*, it is a very efficient remedy. It may be administered with bismuth and pepsin. ℞. Bismuthi subnitrat., ʒj—ʒij; pepsinæ sacch. (Sheffer's), ʒss; zinci oxidi, grs. vj—grs. xij. M. ft. pulv. no. xii. Sig. *One powder every four to six hours.* In the *chronic diarrhœa* both of children and adults the oxide of zinc (from two to ten grains) is serviceable under the same circumstances in which bismuth is presumed to be indicated, but it is a less pleasant remedy in action than the latter. The sulphate (gr. ss—grs. ij) often gives great relief in that form of *dyspepsia* which is the cause of *oxaluria.* In small doses, the sulphate, like most of the mineral remedies of this group, increases for a time the appetite and digestive capacity, but this effect is soon succeeded by gastro-intestinal catarrh, nausea, and loss of appetite. The sulphate as well as the oxide, is an astringent; it arrests the peristaltic movements and causes constipation, and is therefore an appropriate remedy in *chronic diarrhœa* and *chronic dysentery.* In its action and results it is similar to but less efficient than sulphate of copper. It may be combined with opium and ipecacuanha: ℞. Zinci sulphat., pulv. opii, pulv. ipecac., āā grs. xij. M. ft. pil. no. xij. Sig. One pill three or four times a day.

The zinc preparations possess undoubted efficacy in certain disorders of the thoracic organs. The *night-sweats of phthisis* are often prevented by a pill of oxide of zinc and extract of belladonna (three grains of the former and half a grain of the latter) given at bedtime. The zinc is serviceable without the belladonna, but the combined action is more efficient. The sulphate of zinc, by virtue of its astringency, has been prescribed in *bronchorrhœa*, but other agents are now preferred. The oxide of zinc is a serviceable *prophylactic* against the recurrence of the attacks of *spasmodic asthma.* It is also one of the numerous remedies which has been used with a varying degree of success in *whooping-cough:* ℞. Zinci oxidi, ʒj; ext. belladonnæ, grs. v. M. ft. pil. no. xx. Sig. *One pill three times a day.* A prophylactic for asthma, and as a remedy for whooping-cough. The sulphate of zinc (gr ¼—gr. j) and extract of belladonna (gr. ⅛—gr. ss) may be used in combination for the relief of the same cases. It is highly probable that the sulphate of zinc, being more soluble, is much more efficient in the treatment of these neuroses of the digestive organs than the oxide.

The preparations of zinc exert an influence upon the nervous system which has been and is called *antispasmodic.* In certain disorders of the nervous system, of which the chief manifestations are *spasm* and *convulsion* (clonic), they are sometimes very serviceable. Much has been said for and against the oxide of zinc as a remedy for *epilepsy.* A few cases are improved by it; in the great majority it fails utterly. The author expresses with diffidence his conviction that this remedy is most useful in those cases in which the peripheric irritation has its origin in the stomach; it acts by allaying irritability of the terminal filaments of the pneumogastric, and probably also by removing a diseased state of the gastric mucous membrane. *Epileptiform vertigo* and *epileptiform angina pectoris*, when they arise (as they not unfrequently do) from gastric disorder of some kind, are sometimes cured by the oxide of zinc. The so-called *nervous headache* of hysterical women, *nervous cough*, and *aphonia*, due to uterine and ovarian irritation, are often relieved by the valerianate of zinc. Sulphate of zinc is one of the numerous remedies for *chorea*, acting in a manner similar to arsenic, but inferior to this agent in curative power. In *neuralgia* due to reflex irritation from the female pelvic organs, the preparations of zinc, notably the valerianate, are often extremely beneficial. ℞. Zinci valerianat., ℈j; ext. gentianæ, ℈j; ext. nucis vom., grs. v. M. ft. pil. no. xx. Sig. *One pill three or four times a day.* In *chronic alcoholismus*, to relieve the trembling, to diminish the appetite for strong drink, and to relieve the gastric catarrh, the oxide of zinc is very useful: ℞. Zinci oxidi, ʒj; piperin., ℈j. M. ft. pil. no. xx. Sig. *One pill three or four times a day.*

External Uses.—The author has personal knowledge of several cases of *caries* cured by the injection of *Villate's solution.* The following is the composition of this fluid: Sulphate of copper, sulphate of zinc, of each 15 parts; solution of subacetate of lead, 30 parts; vinegar, 200 parts. The sinus or sinuses leading to the carious bone should be thoroughly injected with the solution. It need hardly be remarked that this treatment would not remove a sequestrum.

An excellent caustic for the destruction of *lupus*. *epithelioma*, and *unhealthy ulcers*, is the *dried* sulphate of zinc, which may be freely dusted over the affected surface. A superficial slough forms, the separation of which may be aided by a poultice. The most efficient escharotic consistent with safety is the chloride. No danger is to be apprehended from its absorption, and the strength of the application may be easily regulated. For the destruction of *malignant growths*, chloride of zinc is applied of varying strength, by the admixture of different proportions of flour, or better, of powdered althea-root, so as to form a paste, sufficient water being added. One part of the chloride to two, three, four, or five parts of flour are the proportions advised by Dr. Canquoin. Instead of flour, the chloride may be mixed with anhydrous sulphate of lime. A very convenient and useful mode of applying chloride of zinc is, to mix it, while in a finely-powdered state, with its weight of gutta percha melted with as little heat as possible. The mixture may be moulded into any desired shape. The so-called "caustic arrows" are nothing more than chloride-of-zinc paste, dried and cut into arrow-like slips. These are inserted into the malignant growth, usually at its base, in order to separate it from the healthy tissues.

The salts of zinc are useful applications to certain forms and stages of skin-diseases. In *eczema*, during the secretory stage, the following may be used: ℞. Zinci oxidi, ʒ ij; glycerini, ij; liq. plumbi subacetat., ʒ jss; aquæ calcis ad ℥ vj. M. Sig. *Lotion* (Fox). This formula is serviceable also in *impetigo* and *herpes*. An excellent *absorbent powder for excoriated surfaces* is the following: ℞. Cornmeal, finely sifted, ℥ iv; oxide of zinc, ℥ j; iris powder, ℥ ss; oil of almonds, gtts. x. M. The following is recommended by Neumann in *seborrhœa*, when there is inflammation: ℞. Zinci oxidi, ʒ j; plumbi carbonat., ʒ j; cetacei, ℥ j; ŏl. olivæ q. s. ft. ung. Sig. *Ointment.* In *erythema*, *intertrigo*, and *eczema*, the following lotion is useful: ℞. Aluminis, ℈ j; zinci sulph., grs. x; glycerini, ʒ j; aquæ rosæ, ℥ iv. M. Sig. *Lotion.* For *erythema* and *herpes*, the following may also be used: ℞. Zinci acetat., grs. ij; aquæ rosæ, ʒ j; ung. aquæ rosæ, ℥ j. M. Sig. *Ointment.* The ointments of the oxide of zinc and the cerate of the carbonate are excellent applications in many of the cutaneous affections above named.

Probably the most efficient means for treating *gonorrhœa* consists in the use of a weak zinc-injection frequently repeated. ℞. Zinci chloridi, gr. j; aquæ rosæ, ℥ iv—℥ viij. M. Sig. *As an injection.* ℞. Zinci sulph., grs. viij; aquæ rosæ, ℥ viij. M. Sig. *As an injection.* After the acute symptoms have subsided, the following injection is very effective: ℞. Zinci sulphat., plumbi acetat., āā grs. viij; ammoniæ muriat., aluminis, āā grs. iv; aquæ rosæ, ℥ j. M. Sig. *As an injection.*

The sulphate of zinc is very much prescribed by the ophthalmologists in *conjunctivitis*, *otorrhœa*, etc. It is usually associated with morphia and atropia. ℞. Zinci sulphat., grs. ij—grs. viij; morphiæ sulph., grs. ij—grs. iv; atropiæ sulph., gr. ss—gr. j; aquæ rosæ, ℥ j. M. Sig. *For the eye.*

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Antimonium.—Antimony. *Antimoine*, Fr.; *Antimon*, Ger.

Antimonii et Potassii Tartras.—Tartrate of antimony and potassium. Tartar-emetic. "In transparent crystals, which become white and opaque on exposure to the air. It is wholly soluble in twenty parts of water. The solution yields no precipitate with chloride of barium, or, if very dilute, with nitrate of silver. Hydrosulphuric acid causes an orange-red precipitate. A solution containing one part in forty of water is not disturbed by an equal volume of a solution of eight parts of acetate of lead in thirty-two of water and fifteen of acetic acid." Dose, gr. $\frac{1}{12}$—grs. ij.

Emplastrum Antimonii.—Antimonial plaster. (Tartrate of antimony and potassium, ℥ j; Burgundy pitch, ℥ iv.)

Unguentum Antimonii.—Antimonial ointment. (Tartrate of antimony and potassium, 100 grains; lard, 400 grains.)

Vinum Antimonii.—Antimonial wine. (Solution of tartar-emetic in sherry wine, 32 grains to the pint; two grains to the ounce.) Dose, m. v— ʒ ij.

Syrupus Scillæ Compositus.—Compound sirup of squill. Hive-sirup. (Squill, seneka, tartar-emetic. Contains one grain of tartar-emetic to the ounce.) Dose, m. v— ʒ j.

Antimonii Oxidum.—Oxide of antimony. "A grayish-white powder, insoluble in water, but readily and wholly soluble in muriatic or tartaric acid." Dose, gr. j—grs. iij.

Antimonii Oxysulphuretum.—Oxysulphuret of antimony. "Is a purplish-brown, tasteless powder, soft and velvety to the touch, wholly and readily soluble in muriatic acid with evolution of hydrosulphuric-acid gas." Dose, gr. j—grs. iij.

Antimonii Sulphuratum.—Sulphurated antimony. "Is a reddish-brown powder, insoluble in water." Dose, gr. j—grs. v.

In the remarks which follow, tartar-emetic is the only antimonial preparation referred to, unless otherwise stated. None of the other preparations are employed by modern physicians.

ANTAGONISTS AND INCOMPATIBLES.—Tannic and gallic acids, and vegetable infusions containing them, form an insoluble tannate, and are therefore incompatible. Alkalies and the salts of lead decompose tartar-emetic. It follows that the proper antidotes to poisoning by tartar-emetic are tannic acid (green tea, catechu, rhatany, rhubarb, etc.). Opium, alcohol, ether, etc., and the antispasmodics generally, are physiologically antagonistic.

SYNERGISTS.—The mineral substances of this group promote the action of the antimonials; also the emetics and cathartics, and depressing remedies generally, as veratrum viride, etc.

PHYSIOLOGICAL ACTIONS.—Tartar-emetic has a sweetish, styptic, and metallic taste. In small medicinal doses, it excites a sensation of warmth in the stomach, followed by nausea, increased flow of saliva and buccal mucus, an abundant secretion of the gastric and intestinal glandular apparatus, and also of the liver and spleen. In somewhat larger doses—a half-grain to one or two grains—it excites vomiting, first of the contents of the stomach, then of gastric mucus, and afterward of mucus and biliary matters. The alvine dejections are more fluid and increased in number, and consist at first of fluidified fæces; afterward they are made up of a colored liquid, in which there are present biliary matters and some fæces; and, finally, only a colorless or whitish liquid, having flocculi of epithelium floating in it, and bearing a striking resemblance to the "rice-water discharges" of cholera, is discharged.

The gastro-intestinal symptoms are accompanied by systemic disturbance—paleness of the face, coldness of the surface (sometimes preceded by a very temporary rise of temperature), irregularity and feebleness of the pulse, and great nervous and muscular prostration. When the quantity is sufficient to cause lethal symptoms, they are as follows: epigastric pain, vomiting and purging, shrunken features, cold breath, cyanosis, arrest of the urinary secretion, aphonia, cramps—the assemblage of symptoms belonging to the collapse of cholera.

Tartar-emetic, when used in considerable medicinal doses, sets up an irritation of the fauces followed by aphthous ulcerations, which continue along the œsophagus to the stomach, and are accompanied by salivation and painful deglutition.

Applied to the skin by friction, tartar-emetic excites a follicular inflammation, succeeded by a papule, a vesico-pustule, a surrounding inflammation with indurated base, a central umbilication, and finally desiccation, terminating in a brownish scab. These antimony-pustules are very similar to those of vaccine or variola.

When applied to the skin or injected into the veins, tartar-emetic is absorbed, and manifests a selective action on the gastro-intestinal mucous membrane, causing the same irritant effects as are produced by its stomach administration. It is, therefore, a specific, and not a merely irritant emetic.

Tartar-emetic readily diffuses into the blood. In what form, unless as an albuminate, it exists in the blood, is not understood. It diminishes the number and force of the arterial pulsations, and rapidly lowers the blood-pressure. The pulse may fall from 72 to 40, but, according to Hirtz, rarely is the number reduced more than 6 to 10 per minute. In the healthy subject, the normal temperature, even when a full medicinal dose has been administered, remains unaffected as to the trunk, but it may be reduced in the extremities. In fevers and inflammations, a considerable reduction of temperature may take place, and the same result has been noted in the physiological state when the quantity of tartar-emetic has been sufficient to produce choleriform symptoms.

In man delirium, and in animals paralysis, motor and sensory, but without impairment of muscular contractility, have been observed from lethal doses of tartar-emetic.

Tartar-emetic promotes waste and hastens the elimination of the products of waste—the excretion both of carbonic acid and of urea being greatly increased by it.

The antimonial salts are found in the blood, in the liver, and other viscera, and are excreted by the bile, the milk, the perspiration, and the urine. It is, doubtless, also largely excreted by the intestinal glandular apparatus, as is the case with the metals generally.

If tartar-emetic is administered in small doses, and the quantity be gradually increased, the nauseating effects of the drug may be entirely prevented. When emetic doses even are continued in some subjects, this effect finally ceases, and the drug is borne without producing any gastric symptoms. To this state has been applied the term *tolerance*, by the contra-stimulant school of practitioners. It must not be lost sight of, that this tolerance, on the part of the stomach, of large doses does not mean an indifference to the action of the remedy, but very serious and profound anatomical alterations may result.

THERAPY.—Tartar-emetic was, formerly, much more frequently prescribed than at present as an *emetic* in cases of *indigestion*, characterized by a coated tongue, loaded stomach, and anorexia (*l'embarras gastrique*). It is sometimes used as an emetic in cases of *narcotic poisoning*, but sulphate of zinc is preferable. It was formerly used as an emetic in the first stage of *typhoid and other fevers*, but, notwithstanding this practice is frequently followed by good results, it is now rarely pursued. If emesis is desirable in these cases, a less irritating and depressing emetic should be used.

In *croup* tartar-emetic is an efficient emetic, but it must be used with caution, owing to the great depression which it produces, and the fatal result which has occurred in many instances. It is not a suitable remedy for infants and very young children. The compound sirup of squills is a domestic remedy for croup, but the incautious use of this has proved fatal. Tartar-emetic is used in *laryngismus stridulus* to produce emesis and consequent relaxation of the muscles of the larynx, and in *true croup* to cause the expulsion of the false membrane. The yellow subsulphate of mercury is safer and quite as effective.

Tartar-emetic is an excellent remedy in the first stage of *acute catarrh, nasal, pharyngeal, and bronchial.* It is most efficient in the first stage, when the mucous membrane is dry and swollen. It promotes secretion, diminishes fever, induces diaphoresis, and hastens the elimination of inflammatory products. In these cases, from one-twentieth to one-twelfth of a grain is usually a sufficient quantity, for it is not necessary that nausea be excited. When cough is violent, a little opium may be added to the prescription. ℞. Antimonii et potassii tart., gr. ss; morphiæ acetat., gr. ss; aquæ, ℥ij. M. Sig. *A teaspoonful every hour or two.* In *acute bronchitis*, when the cough is dry and hoarse, this agent is useful, and small doses (one-sixteenth of a grain), fre quently repeated, are more serviceable than large doses at longer intervals.

Formerly, under the influence of the contra-stimulant school, tartar-emetic was given in large doses in *pneumonia.* It was sought to establish *tolerance* at an early period, and to administer the largest doses which could be borne. The comparative results of this method of treatment and of the expectant and restorative plans demonstrate the impropriety of the tartar-emetic treatment, and it is now abandoned. It is true that small doses of tartar-emetic, by increasing the action of the skin, kidneys, and intestinal canal, may exert a favorable influence over the temperature and diminish the plasticity of the exudation; but even small doses must be employed with care, lest a depression should be induced which may interfere seriously in the natural course of a disease which is self-limited and has its period of crisis.

Tartar-emetic gives great relief in *spasmodic asthma when the bronchial secretion is deficient*, and in those cases brought on by an overloaded stomach. In the former case small doses frequently repeated until very slight nausea is produced, and in the latter emetic doses, are necessary. The following is a useful form of expectorant in the acute inflammatory affections of the air-passages: ℞. Antimonii et potassii tart., gr. j; ammonii muriat., ℈iv; ext. glycyrrhizæ, ℈j; morphiæ muriat., gr. j; syrup. tolutan., aquæ lauro-cerasi, āā ℥j. M. Sig. A teaspoonful every two, three, or four hours.

The ointment of tartar-emetic was formerly much employed to produce *pustulation of the chest* in the more *chronic pulmonary diseases.* This painful and disfiguring form of counter-irritation has passed out of use. To produce a crop of variolus-like pustules on the skin does not cause a morbid process like caseous pneumonia or tuberculosis to cease its ravages; on the contrary, such extensive suppuration in the skin rather favors the development of these diseases.

A combination of tartar-emetic and opium is a serviceable *hypnotic* in some cerebral disorders. These remedies appear to be most useful when *wakefulness and delirium are due to cerebral congestion*, and in those subjects who become excited and wakeful from the use of opium alone. In the *active delirium and wakefulness of typhoid fever*, tartar-emetic and opium are prescribed: ℞. Antimonii et potassii tart., gr. j—grs. ij; morphiæ sulph., gr. jss; aquæ lauro-cerasi, ℥j. M. Sig. *A teaspoonful every two, three, or four hours.* In *delirium tremens*, when the same conditions exist, the same combination may be prescribed. Since the introduction of chloral and bromide of potassium, however, the use of these drugs for the purposes just indicated has been much restricted.

In acute inflammatory and febrile diseases, minute doses of tartar-emetic (gr. $\frac{1}{16}$), frequently repeated, render an incontestable service. *Typhoid, typo-malarial, and remittent fevers, acute rheuma-*

tism, *erysipelas*, etc., are maladies thus benefited. This remedy is, of course, contraindicated when there is much irritability of the stomach and intestinal canal. *At the outset of fevers* it was formerly the custom to prescribe an active emetic, and good results certainly followed this practice. The author believes that he has frequently seen impending attacks of *malarial fever* aborted by emetic doses of antimony and ipecac. Free emeto-catharsis moderates the severity of *remittent fever* in robust subjects when produced in the incipiency of this disease, and also puts the mucous membrane in a better state for the disposition of medicines and food.

Before the days of anæsthesia tartar-emetic was much used to relax the *muscular system* for the *reduction of dislocations*, to *facilitate the taxis in strangulated hernia*, to *relieve rigid os and perinæum in labor, etc.*, but it is now no longer employed for these purposes.

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RADZIEJEWSKY, DR. S. *Schmidt's Jahrbücher der gesammten Medicin*, vol. cliii., p. 10, *Zur Wirkung des Antimon.*

TAYLOR, DR. A. S. *On Poisons*, American edition, p. 476.

TROUSSEAU ET PIDOUX. *Traité de Thérapeutique et de Matière Médicale*, edition by Paul, huitième édition, vol. ii., p. 951.

Cadmium.—Cadmium. *Cadmium*, Fr.; *Kadmium*, Ger.; *Cadmii Sulphas*, Sulphate of Cadmium.

ACTIONS AND USES.—There is a strong resemblance—an identity of action, indeed—between zinc and cadmium, except that the latter is the stronger. Cadmium has a decidedly caustic and astringent taste; it is powerfully nauseant and emetic, producing great depression of the powers of life. Locally the effects are those of an irritant poison, and the systemic effects correspond; although there are produced such cerebro-spinal symptoms as coma and convulsions. This agent is not administered internally, the preparations of zinc being preferred for all purposes to which cadmium might be applied as a remedy.

In ophthalmic practice, cadmium seems to be much esteemed as a *collyrium*. It is held to possess special powers in causing absorption of *opacities of the cornea:* ℞. Cadmii sulph., grs. ij; aquæ rosæ, ℥ j. M. Sig. *Collyrium.* A solution of the same strength is said to be an excellent local application in *otorrhœa.* There is no doubt that cadmium is an efficient injection in *gonorrhœa;* but it is important in the application of this, as of so many other astringent remedies, that it be not too strong—one grain of cadmium sulphate to four ounces of water being sufficient in most cases.

An ointment of cadmium is used somewhat by French physicians, in the treatment of external affections. For this purpose we may direct ten grains of the sulphate to be intimately incorporated with an ounce of simple ointment.

Cerium.—*Cerii Oxalas*, Oxalate of Cerium. A white powder, insoluble in water, alcohol, and ether. Dose, two to five grains in pill-form, as it is insoluble in the ordinary menstrua. It may be suspended in mucilage.

Sir James Simpson was the first to propose the use of oxalate of cerium to restrain *vomiting* arising from various causes, especially from *pregnancy;* and he brought forward many cases illustrative of its value. As he pointed out, it sometimes succeeds immediately, but usually the best effects are experienced after several days' use. The oxalate of cerium sometimes succeeds remarkably in vomiting due to serious organic lesions, as in cancer (Peters). It has been narrated in one case, that four grains were administered every two hours until about 600 grains were taken. The good result which followed this large administration of the drug indicates that, in vomiting from similar causes, larger doses may be sometimes necessary to secure the best curative effects. In *chronic diarrhœa*, cerium may take the place of bismuth.

Authorities referred to:

PETERS, DR. JOHN C. *New York Medical Record*, 1877.

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Alumen.—Alum. *Alun*, Fr.; *Alaun*, Ger.

Aluminii et Potassii Sulphas.—Potassa alum. "A white, slightly-efflorescent salt, crystallizing in regular octahedrons, and possessing an acid, sweetish, astringent taste. It dissolves in from fourteen to fifteen times its weight of cold, and three-fourths of its weight of boiling water, but is insoluble in alcohol."

Alumen Exsiccatum.—Dried alum. Alum deprived of its water of crystallization by heat.

Aluminii Sulphas.—Sulphate of aluminium. "Has a sour, somewhat sweetish, and astringent taste, and an acid reaction. It is soluble in twice its weight of water."

ANTAGONISTS AND INCOMPATIBLES.—Alkalies and their carbonates and acetate of lead are chemically incompatible.

SYNERGISTS.—The mineral and vegetable astringents promote its therapeutical activity.

PHYSIOLOGICAL ACTIONS.—The sweetish taste of alum first experienced is quickly followed by a decided astringency. It provokes an abundant flow of saliva, and the albumen of the saliva and buccal mucus is coagulated in whitish, membrane-like flakes. Contraction of the capillaries, blanching of the mucous membrane, and subsequent diminution of secretion, take place; hence the dryness of the throat, thirst, and constipation, which result from its use. In doses of a teaspoonful, or more, alum is an efficient emetic. Under certain morbid states it also proves laxative. Notwithstanding its power to coagulate albumen, it is absorbed into the blood, as was shown by Orfila, and may be found in the liver and in the urine. Circulating in the blood, alum affects the capillaries, diminishing their calibre, lessens secretion, especially of the mucous membranes, and arrests hæmorrhage. In very large doses alum produces decided irritant effects—nausea, vomiting, abdominal pain, diarrhœa, etc.

Dried alum, in consequence of its strong affinity for water, and its power to coagulate albumen, is a mild escharotic.

Therapy.—Alum is one of the remedies which may be used in *gastric catarrh.* It is said to be most effective when there is vomiting of glairy mucus. ℞. Aluminis, ʒ ij; extract. gentian., ʒ ss. M. ft. pil. no. xxx. Sig. *Two pills three times a day.* Alum is a serviceable hæmostatic in *hæmatemesis.* It is, of course, adapted only to cases of passive hæmorrhage, when there is a relaxed condition of the mucous membrane. Other astringents—as, for example, Monsel's salt—are more effective. When *intestinal hæmorrhage* is dependent on mechanical causes (cirrhosis, for example), and the mucous membrane is free from acute inflammation, alum is a serviceable astringent. It was formerly much used in *chronic diarrhœa* and *chronic dysentery,* but more effective agents are now employed in these diseases. The following formulæ are applicable to the above-mentioned diseases, in the absence of more suitable agents: ℞. Aluminis, ʒ ij; pulv. aromat., ʒ j; pulv. opii, grs. vj—grs. xij. M. ft. pulv. no. vj. Sig. *One powder, in honey or sirup, three times a day or oftener.* ℞. Aluminis, ʒ j; extract. opii, grs. x; catechu, ʒ j. M. ft. pil. no. xx. Sig. *Two pills every two, three, or four hours.* ℞. Aluminis, ʒ ij; pulv. opii, grs. iij—grs. vj; pulv. kino, ℈ j; sacch. lactis, ʒ j. M. ft. pulv. no. vj. Sig. *One powder every three hours.*

It is a singular fact that the most effective agent for the cure of *colica pictonum* is alum. It relieves the pain and nausea, and overcomes the constipation, more certainly than any other agent. The chemical theory of its action is entirely unequal to the explanation of its remarkable effects; the conversion of any portion of the lead present in the intestinal canal into the insoluble sulphate would not suffice to quiet pain, relieve flatulence, and relax the obstinately-constipated bowels. Its action is doubtless dynamical; it overcomes the relaxation and paresis of the muscular layer, on which the phenomena of lead-colic depend. The following are convenient formulæ for the administration of alum in this disease: ℞. Aluminis, ʒ ij; acid. sulphuric. dil., ʒ j; syrp. limonis, ℥ j; aquæ, ℥ iij. M. Sig. *A tablespoonful every hour or two.* ℞. Aluminis, ʒ ij; vini, ℥ iv; catechu, ʒ j; tragacanthæ, ʒ j; aquæ, ℥ viij. M. Sig. *A tablespoonful every hour.* Alum-whey, prepared as follows, may be used in lead-colic: To a pint of boiling milk, add ninety grains of alum-powder; separate the curd, and sweeten the whey if desired with an ounce of white sugar. A wineglassful may be taken every hour or two.

Alum not unfrequently affords relief in *gastralgia*, *enteralgia*, and *catarrh of the intestines.* It is a serviceable laxative in females of lax fibre, in whom constipation depends upon a paretic state of the muscular layer of the bowel. It is true that we possess many other agents more agreeable for administration, and also more effective; but alum is cheap, and always to be obtained.

Alum, dissolved in infusion or solution of the extract of logwood, is a useful injection in *hæmorrhage from the rectum*, or as an application to *bleeding piles*, or as an astringent wash in *prolapsus of the rectum in children.* A crystal of alum, cut into a globular shape, may be passed into the rectum in such cases. The following ointment may be applied to hæmorrhoids when they protrude, bleed, and are painful: ℞. Pulv. aluminis, ʒ ij; pulv. camphoræ, pulv. opii, āā ʒ j; unguent., ℥ j. M. Sig. *Ointment.*

Notwithstanding the theoretical objections which have been made as to its utility, the use of alum is sanctioned by high authority in *hæmorrhages* from distant organs of the body. Oppolzer recommends the following formula: ℞. Aluminis, amyli, āā ʒ j; sacchari, ʒ ij. M. ft. pulv. no. vj. Sig. *One powder every two hours.* Skoda advises the following formula in *hæmoptysis:* ℞. Aluminis, ʒ j; sacch. alb., ʒ ss; pulv. ipecac. comp., ℈ j. M. ft. pulv. no. vj. Sig. *One powder every two hours.*

Alum was formerly used in *diabetes mellitus*, but more effective methods of treatment have taken its place. Good results have certainly been produced by the use of alum in *diabetes insipidus.* *Colliquative sweats* are moderated by the internal use of alum, and by sponging the surface with a solution.

Alum has been used with a certain measure of success in *whooping-cough*, during the spasmodic stage, but the more certain and palatable remedies now in our possession have quite displaced it. As an *emetic in croup*, there is no doubt of the utility of alum. It is used to cause the dislodgement of the false membrane, and to prevent its reformation. It acts without depressing the bodily functions, is prompt, and thorough. A teaspoonful of the powder, mixed with honey or sirup, may be given, and repeated every half-hour until free emesis occurs.

External Uses of Alum.—A solution of alum, in nitric ether, is said to be an effective application in *toothache* (ʒ ij—ʒ vij). When the *gums are spongy and ill-conditioned*, and manifest a tendency to recede from the teeth, the following local application is very serviceable: ℞. Aluminis, ʒ j; vini, O j; tinct. cinchonæ, ℥ ss; tinct. myrrhæ, ʒ ij; mel. rosæ, ℥ ij. M. Sig. *As a gargle.* When there is much relaxation of the faucial mucous membrane, alum and sugar, in equal proportions, may be applied by an insufflation-tube. Powdered alum, dusted over the affected surface, is a useful application in *chronic pharyngitis, chronic tonsillitis, chronic nasal catarrh. Ulcers of the mouth,* whether syphilitic, or due to nursing, or arising from gastric disorder, are improved in character by application of a crystal of alum. A useful gargle in various affections of the mouth and throat is the following: ℞. Infus. lini, ℥ xv; tinct. kino, ℥ j; aluminis, ʒ ij. M. Sig. *As a gargle.*

In *catarrhal ophthalmia,* after the acute symptoms have subsided, an alum-lotion is useful. ℞. Aluminis, ℈ j; aquæ rosæ, ℥ iv. M. Sig. *Lotion.* Alum-curd is a domestic application which is often serviceable: ʒ ss of alum to the white of an egg.

The following is a useful injection in *chronic gonorrhœa:* ℞. Aluminis, ʒ j; zinci sulphatis, ʒ ss; sodii biborat., grs. iv; aquæ rosæ, ℥ viij. M. Sig. *An injection.* This prescription is equally applicable to *leucorrhœa.*

Alum is a useful *hæmostatic,* but there are others more powerful. Alum is a constituent of the once famous Pagliari's mixture (Mentel's). ℞. Benzoini, gr. c; alcohol. fort., ℥ ss. Dissolve and add water, ℥ x; alum, ℥ j. The mixture is to be boiled until clear, and, when cool, filtered. This is also a good preservative solution for anatomical preparations, and is an effective application in *leucorrhœa, pruritus of the vulva,* etc.

Alum ℥ ss, the whites of four eggs, and tincture of camphor ℥ ij, is an excellent application to *bed-sores.* Burned alum is a mild escharotic, which is sometimes used to destroy *exuberant granulations.*

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TROUSSEAU ET PIDOUX. *Traité de Thérap.,* etc., vol. i., p. 188.
WALDENBURG UND SIMON. *Handbuch der Arzneiverordnungs-Lehre,* p. 154.
UNITED STATES DISPENSATORY, thirteenth edition.

Acidum Tannicum.—Tannic acid. *Tanin,* Fr.; *Tanninum,* Ger.

"Tannic acid has a yellowish-white color, and strongly astringent taste. It is decomposed and entirely dissipated when thrown on red-hot iron. It is very soluble in water, and less so in alcohol and ether. Its solution reddens litmus, and produces, with solution of gelatine, a white, flocculent precipitate; with the salts of the sesquioxide of iron a bluish-black precipitate; and with solutions of the alkaloids white precipitates, very soluble in acetic acid." Dose, gr. j—℈ j.

Glyceritum Acidi Tannici.—Glycerite of tannic acid. (Tannin, ℥ ij; glycerin., ℥ viij.)

Unguentum Acidi Tannici.—Ointment of tannic acid. (Tannin, ʒ ss; lard, ℥ j.)

Suppositoria Acidi Tannici.—Suppositories of tannic acid. (Tannin, ʒ j; ol. theobromæ, ʒ v.)

Acidum Gallicum.—Gallic acid. *Acide Gallique*, Fr.; *Galläpfelsaure*, Ger.

"Gallic acid is in small, silky, nearly colorless crystals, having a slightly acid and astringent taste. It is soluble in one hundred parts of cold, and in three of boiling water. The solution reddens litmus, and does not produce a precipitate with a solution of gelatine, or of sulphate of protoxide of iron. With solutions of salts of sesquioxide of iron, it produces a bluish-black precipitate, the color of which disappears when the liquid is heated. It is decomposed by a strong heat, and entirely dissipated when thrown on red-hot iron." Dose, gr. j—grs. x.

Glyceritum Acidi Gallici.—Glycerite of gallic acid. (Gallic acid, ℥ ij; glycerin., ℥ viij.)

The following remedies contain a tannic acid, and have physiological and therapeutical actions due to the presence of this substance:

Galla.—Nutgall. *Noix de galle*, Fr.; *Galläpfel*, Ger.

Tinctura Gallæ.—Tincture of galls. Dose, ʒ ss—ʒ ij.

Unguentum Gallæ.—Ointment of galls. (Galls in fine powder, ʒ j; lard, 420 grains.)

Composition.—Tannic acid (gallo-tannic), 60 to 70 per cent.; gallic acid, 3 per cent.; sugar, resin, etc.

Catechu.—Catechu. "An extract prepared principally from the wood of Acacia Catechu." *Cachou*, Fr.; *Katechusafe*, Ger.

Tinctura Catechu.—Tincture of catechu. (Catechu, ℥ iij; cinnamom., ℥ ij; diluted alcohol, Oij.) Dose, m. x—ʒ j.

Infusum Catechu Compositum.—Compound infusion of catechu. (Catechu, ℥ ss; cinnamon, ʒ j; boiling water, Oj.) Dose, ʒ j—℥ ss.

Composition.—Catechin, or catechuic acid.

Kino.—Kino. "The inspissated juice of Pterocarpus Marsupium, and of other plants." *Kino de l'Inde*, Fr.; *Kino Gummi*, Ger.

Tinctura Kino.—Tincture of kino (ʒ vj—Oss). Dose, m. x—ʒ ij.

Composition.—Kino-tannic acid.

Krameria.—Rhatany. "The root of Krameria triandra." *Ratanhia*, Fr.; *Ratanhiawurzel*, Ger.

Extractum Krameriæ.—Extract of rhatany. Dose, grs. v—grs. x.

Infusum Krameriæ.—Infusion of rhatany (℥ j—Oj). Dose, ℥ ss—℥ j.

Extractum Krameriæ Fluidum.—Fluid extract of rhatany. Dose, m. v—ʒ ss.

Syrupus Krameriæ.—Sirup of rhatany. Dose, ʒ j—ʒ iv.

Composition.—Ratanhia-tannic acid; odorous principle; wax, gum, etc.

Hæmatoxylon.—Logwood. "The heart-wood of hæmatoxylon Campechianum." *Bois de Campêche*, Fr.; *Campecheholz*, Ger.

Decoctum Hæmatoxyli.—Decoction of logwood. (Logwood, ℥ j; water, Oij, boiled down to Oj.) Dose, ℥ ss—℥ j.

Extractum Hæmatoxyli.—Extract of logwood. Dose, grs. v—℈ j.

Composition.—Hæmatoxylin, tannic acid, etc.

Geranium.—Cranesbill. "The rhizoma of Geranium maculatum."

No officinal preparations.

Composition.—Tannic and gallic acids, resin, gum, starch, chlorophyll, etc.

Quercus Alba.—White-oak bark.

Quercus Tinctoria.—Black-oak bark. *Écorce de chêne*, Fr.; *Eichenrinde*, Ger.

Decoctum Quercus Alba.—Decoction of white-oak (℥ j—Oj). Dose, ℥ ss—℥ j.

Composition.—Quercitrine or quercitric acid, tannic acid, etc.

Rosa Gallica.—Red rose. "The petals of Rosa Gallica." *Roses rouges*, Fr.; *Essigrosen*, Ger.

Confectio Rosæ.—Confection of rose.

Infusum Rosæ Compositum.—Compound infusion of roses. (The infusion contains ʒ iij of diluted sulphuric acid in two and a half pints.)

Mel Rosæ.—Honey of rose.

Composition.—Tannic and gallic acids, quercitrine, coloring matter, volatile oil, etc.

Rubus.—Blackberry-root. Root of Rubus Canadensis and Rubus villosus.

Syrupus Rubi.—Sirup of blackberry. Dose, ʒ j—℥ ss.

Aromatic sirup of blackberry, which is not officinal, contains blackberry-root, cinnamon, cloves, and mace. A fluid ounce contains the strength of thirty grains of the root.

Composition.—Tannic acid, etc.

Myrica Cerifera.—Bayberry, Wax-myrtle (not officinal). Bark of the stem and root.

Decoction is made by boiling an ounce in a pint of water—dose, ℥ ss — ℥ j. An alcoholic extract (*myricine* of the eclectics)—dose, grs. v; and a fluid extract—dose, ʒ ss— ʒ ij—are to be obtained in the shops.

Composition.—Tannic and gallic acid, myricinic acid, resin, red coloring matter, etc.

The most important property is the astringency due to the large quantity of tannic and gallic acids. In large doses it is emetic.

Statice Limonium.—Marsh rosemary. (Not officinal.) The root. A decoction (℥ j—Oj) may be used—dose, ℥ ss— ℥ j. A fluid extract is prepared—dose, m. xx— ʒ j.

Composition.—Tannic acid (twelve per cent.) gum, extract, etc.

Alnus Serrulata.—Common alder. (Not officinal.) The bark in decoction (℥ j—Oj)—dose, ℥ ss— ℥ j. Fluid extract—dose, m. x— ʒ j. Alcoholic extract (*Alnuin* of the eclectics) dose, gr. j—grs. v.

Composition.—Tannic acid, oil, resin, etc.

Henchera.—Alum-root. United States Secondary List. Root of Henchera Americana. Decoction—dose, ℥ ss— ℥ j; fluid extract—dose, m. x— ʒ j. (Not officinal.)

Composition.—Tannic acid, etc.

Hamamelis Virginica.—Witch-hazel. Bark and leaves. Decoction (℥ j—Oj)—dose, ℥ ss— ℥ j. Fluid extract—dose, ʒ ss— ʒ ij. (Not officinal.)

Composition.—Tannic acid, odorous matters, etc.

Nymphæa Odorata.—Sweet-scented water-lily. Root. Decoction (℥ j—Oj) —dose, ℥ ss— ℥ j. Fluid extract—dose, ʒ ss — ʒ j. (Not officinal).

Composition.—Tannic acid, gallic acid, etc.

Castanea Vesca.—Chestnut-leaves. (Not officinal.) Decoction (℥ j —Oj)—dose, ℥ ss— ℥ ij. Fluid extract—dose, ʒ j— ʒ ij.

Composition.—Tannic acid, etc.

(Used more especially as a remedy for whooping-cough.)

Antagonists and Incompatibles.—The mineral acids, the salts of antimony, lead, and silver, and the persalts of iron, and alkalies, are chemically incompatible. The vegetable alkaloids and gelatine form insoluble precipitates.

Synergists.—Tonics and bitters, as a rule, favor the action of tannic and gallic acids, and of the substances containing them. The agents comprehended in this group—or remedies whose chief result is to increase waste—are synergistic.

Physiological Actions.—Tannin has a bitter astringent taste, and constringes the mucous membrane. In the stomach it enters into combination with albumen, and with the pepsin of the gastric juice, which it precipitates from its solution. Tannin, therefore, impairs digestive power by rendering the pepsin inoperative. It diminishes secretion of the mucous membrane by virtue of its power to diminish the calibre of the vessels, and it restrains peristalsis by its action on the muscular layer; hence the constipating effects which follow its use. If long continued in considerable quantity, tannin disorders digestion, sets up irritation of the mucous membrane, and gives rise to a febrile state and to wasting of the tissues.

Having such affinity for and coagulating action on albumen, it is obvious that tannin must diffuse into the blood with difficulty. A part undergoes conversion into gallic and pyro-gallic acids in the stomach, and in this form is absorbed. Injected into the veins, tannic acid coagulates albumen, and the results which follow are due to multiple embolisms. Elimination of tannin takes place by the intestinal canal and by the kidneys, in the form of gallic and pyro-gallic acids.

Therapy.—*Catarrh of the stomach, a relaxed state of the mucous membrane, acidity, and flatulence*, are conditions in which tannic acid is useful. It may be given in pill-form with sufficient glycerine to make a mass of proper consistence—one drop to four grains. *Hæmatemesis* dependent on ulcer of the stomach, or obstructive disease of the liver, and not inflammatory in origin, is an indication for tannin. It should be given in solution and in a large dose—grs. x—℈j. Tannic acid is an efficacious remedy in *diarrhœa*, after acute symptoms have subsided, in *chronic diarrhœa, colliquative diarrhœa*, the *diarrhœa of phthisis*, etc. Notwithstanding the chemical incompatibility, combination with opium or morphia increases the efficacy of the tannin. As tannic acid in large part, at least, escapes conversion into gallic, and passes unchanged into the intestine, its action is doubtless chiefly local. Oppolzer advises the following formula in *profuse diarrhœa:* ℞. Acidi tannici, ℥ ss; pulv. opii, grs. vj; sacchari, q. s. M. ft. pulv. no. vj. Sig. *One every two hours.* In *cholera diarrhœa*, A. von Graefe prescribed a solution of tannic acid in cinnamon-water and mucilage every half-hour. For the *diarrhœa* and *intestinal hæmorrhage of typhoid fever*, tannin is one of the most serviceable remedies. According to Stillé, whose faith appears rather extravagant, there is no more effective remedy for *chronic diarrhœa* and *chronic dysentery* than tannic acid conjoined with a milk-diet.

Various members of this group are used in the above-mentioned diseases. Kino has been a favorite remedy in *pyrosis*, and is also given in *diarrhœal diseases.* Catechu, in the form of the tincture chiefly, is frequently added to prescriptions for diarrhœa, notably to chalk-mixture in the diarrhœa of children. Kino is a favorite remedy for the *diarrhœa of phthisis*, but it is not more efficacious, and is more disagreeable in administration, than tannic acid. Several of the indigenous remedies mentioned above possess undoubted value in the treatment of diarrhœal diseases. A decoction of rubus or geranium, obtained by boiling the root in milk (℥ j—Oj), is an excellent remedy in *cholera infantum* and the *summer diarrhœa of children.* When a nursing child passes rather frequent, greenish, and watery stools, and suffers with pain and colic at each motion, great relief will be afforded by the use of syrupus rubi, or better by the unofficinal compound sirup of rubus. In the *chronic diarrhœa* of adults, and in *acute diarrhœa after the subsidence of inflammatory symptoms*, the fluid extracts of hamamelis, of henchera, and of statice, may be used with advantage. In *hæmatemesis* and *intestinal hæmorrhage* the hamamelis is very effective, owing doubtless to the very large percentage of tannin which it contains.

The comparative merits of tannic and gallic acids may be formularized as follows: for local effects tannic acid, for systemic effects gallic acid is to be preferred. It is true that tannic acid affects remote parts, but in order to diffuse into the blood it must first be converted into gallic, and hence the systemic actions are really due to the latter. It follows that gallic acid should be prescribed when the astringent effects on the tissues elsewhere than the intestinal canal are to be produced. Gallic acid is an effective remedy for *pulmonary* and *renal hæmorrhage.* For the former we possess other agents more efficient, but for the latter it is more uniformly successful than any other remedy. The success of rhatany, which was formerly much used in *hæmaturia*, was doubtless due to its tannic and gallic acids. In the *hæmorrhagic diathesis*, gallic acid is one of the remedies which may be used with advantage. Although it cannot be combined with chalybeates, it may be given alternately with them. Whenever hæmorrhage occurs in relaxed and debilitated constitutions—is passive in character—gallic acid may be combined with ergotine and digitalis: ℞. Acid. gallici, ʒ i; ergotine (aq. ex.), digitalis, āā ℈ j. M. ft. pil. no. xx. Sig. *One every four hours.*

As gallic acid has the power to restrain secretion of mucous surfaces, it may be prescribed, experience has shown with good effect, in *chronic bronchial catarrh.* When bronchiectasis exists, the good effects of the remedy are by no means conspicuous, but it is very serviceable when the bronchial catarrh is the result of the irritation extending from disease of the parenchyma of the lungs, or is produced by mitral or tricuspid regurgitation, or is the sequel of acute catarrh. In *pyelitis* and *pyelo-nephritis*, gallic acid and the remedies containing it diminish the purulent discharge, and retard changes in the mucous membrane. It is also a serviceable remedy in *catarrh of the bladder.* In these states, to insure as far as possible its rapid and complete diffusion into the blood, it should be given frequently and well diluted. As it is soluble in eight parts of rectified spirit, and, as this solution mixes in all proportions with water without precipitation, a spirituous solution should be prescribed: ℞. Acidi gallici, ʒ j; spirit. vini rectif., ℥ j. M. Sig. *A teaspoonful in sufficient water every four hours.*

Gallic acid has the power to restrain the waste of albumen in cases of *albuminuria*. It is adapted to the acute forms—*desquamative nephritis*, the *albuminuria following scarlatina*, etc., and does not seem, according to the author's observation, to check in the least the loss of albumen in the chronic forms of albuminuria. Dr. Aitken recommends the following formula: ℞. Acidi gallici, ʒ j—ʒ ij; acid. sulphuric. dil., ʒ ss; tinct. lupuli, ʒ i; infus. lupuli, ℥ vj. M. Sig. *A tablespoonful three times a day.*

The following mixture is very effective in *menorrhagia*, *hæmaturia*, *purpura hæmorrhagica*, and the *hæmorrhagic diathesis:* ℞. Acidi gallici, ʒ ss; acid. sulphur. dil., ʒ j; tinct. opii deod., ʒ j; inf. rosæ comp., ℥ iv. M. Sig. *A tablespoonful every four hours or oftener.*

Hillier advises the following prescription for *chronic diarrhœa* in a child of two years: ℞. Acidi gallici, gr. xij; tinct. cinnamomi comp., ʒ jss; tincturæ opii, m. viij; aquæ carui ad ℥ ij. M. Sig. *Two teaspoonfuls a dose.*

For the *sweating of phthisis* the following formula is useful: ℞. Acid. gallici, ʒ ss; ext. belladonnæ, gr. ij. M. ft. pil. no. x. Sig. *Two pills at bed-hour.*

In addition to the foregoing internal applications of the vegetable astringents, it may be mentioned that a decoction of chestnut-leaves (castanea) has been used with much success in *whooping-cough*. As both tannic and gallic acids have been employed with more or less service in this disorder, it is probable that the good effects of castanea are really due to the presence in it of these acids. The decoction of castanea may be drunk *ad libitum*, or the fluid extract may be administered in drachm-doses.

External Uses of Tannic Acid and Substances containing it.—Dr. B. W. Richardson has proposed a tannin solution, to which he has applied the term *styptic colloid*. It consists of a saturated solution of tannin in alcohol (one part to eight) mixed with collodion. This is an elegant application to restrain *oozing of blood from a large surface*, *to unite incised wounds*, *to protect lacerated wounds*, *to remove fetor from decomposing animal matter*, *to change the character of foul ulcers*, etc. The following formula was proposed by Monsel as a *hæmostatic:* ℞. Acidi tannici, ℈ j; aluminis, ℈ ij; aquæ rosæ, ℥ iij. M. Sig. *For external use as a hæmostatic.* The officinal glycerite of tannin is a neat formula for external application.

Tannic acid is much employed as an application to the mouth and throat in various diseases of these parts. In *mercurial salivation* an excellent application is a solution of tannin, with honey of roses: ℞. Acidi tannici, ʒj; mel rosæ, ℥ij; aquæ, ℥vj. M. Sig. *As a gargle. Elongated uvula, relaxed palate,* and *follicular pharyngitis,* are effectively treated by insufflation of tannin, i. e., some finely-powdered tannin blown over the affected surface with a hand-ball insufflator. *Epistaxis* may often be promptly arrested by passing through the nares a strong solution of tannin (ʒij—℥iv) by means of a post-nasal syringe or nasal douche, or powdered tannin may be blown on the bleeding surface by an insufflator. The following is an excellent *gargle* for the more chronic throat-affections: ℞. Acidi tannici, ʒij; spts. vini rect., ʒj; mist. camphor. ad ℥x. M. Sig. *An astringent gargle.* In chronic affections of the larynx mucous membrane, and of the vocal cords, no inhalation is more frequently serviceable than a solution of tannin (grs. x—℈j—℥iv) applied by means of the hand-ball or steam-atomizer. This treatment is useful in *chronic catarrh of the fauces, of the larynx, trachea, and bronchi,* in *ulcerations of the pharynx, larynx, and trachea,* in *bronchiectasis,* in *pulmonary hæmorrhage, gangrene of the lung, œdema of the glottis, croup, and diphtheria.*

The following is Druitt's prescription for *toothache:* ℞. Acidi tannici, ℈j; mastich, grs. x; etheris, ℥ss. M. Sig. To be applied on cotton to a carious tooth.

Tannin solutions of various strengths (gr. j—grs. x—℥j) are used in *inflammation of the conjunctiva.* Hairion advises a strong solution (ʒj—ʒiij)) in *acute and chronic conjunctivitis, granulations, corneitis, chemosis, and pannus.* Very remarkable results have been obtained by Dr. Hamilton, of Liverpool, in certain diseases of the eye by the application of powdered tannin to the conjunctiva. This method consists in dusting over the everted lid finely-powdered tannic acid, using for this purpose a small rubber-bag insufflator. He employs this method with signal success in "*granular ophthalmia, pannus, phlyctenular* or *pustular ophthalmia, chronic granulations, herpes corneæ, fascicular corneitis, and some ulcers of the cornea.*" This application produces very little pain at the moment, and is not followed by any inflammatory reaction.

Tannic acid has limited uses in diseases of the skin. It is an excellent application, especially in the form of the glycerite, in *eczema, impetigo,* and *intertrigo.* The powder dusted on the affected surface is serviceable in cases of *ulceration of the skin,* and promotes the healing process in cases of old ulcers. One of the best applications to *irritable and fissured nipples* is *glycerite of tannin.*

Chronic otorrhœa and the *vulvitis of children* are successfully treated by application of the glycerite of tannin. The same remedy is one of the best injections in *gonorrhœa.* Solutions of tannic acid of various degrees are used in gonorrhœa. Ricord recommends, in obstinate cases, after the subsidence of acute symptoms, ʒ ss of tannic acid in ℥ viij of claret wine. This constitutes a serviceable injection in *leucorrhœa.* Sigmund advises the following in *gonorrhœa:* ℞. Acidi tannici, grs. ij—grs. x; tinct. iodinii, m. v; aquæ, ℥ j. M. Sig. *As an injection.* An infusion or decoction of galls, of oak-bark, of witch-hazel (hamamelis), of geranium, of alum-root, or other remedies of the list at the head of this article, may be advantageously used in *cervicitis, vaginitis, purulent discharges from the vagina.* In these affections the glycerite of tannin, and, much better, the powdered tannin, may be freely applied to the vaginal canal. The author knows of no more effective application in these maladies than tannin and iodoform, or iodo-tannin, applied in the dry way, well packed around the *cervix uteri.*

A serviceable ointment for *hæmorrhoids* is the following prescription of Oesterlen: ℞. Pulv. gallæ, ℈j; pulv. opii, grs. x; ung. plumbi subacetat., ℈ij; ung. simplicis, ʒ j. M. Sig. *Ointment for hæmorrhoids.* For *prolapsus ani* in children the glycerite of tannin, powdered tannin, or a decoction of the vegetable astringents considered in this article, may be used, the mucous membrane being first carefully cleansed and then brushed over with the medicament. *Ulcers of the rectum and anus, fissures of the anus,* are very effectively treated by the direct application of the powder of tannin, tannin and iodoform, or iodo-tannin. The ulcer must be exposed, if necessary, by the use of the speculum, and then the powder be thoroughly applied to the affected surface. Trousseau strongly recommends a mixture of the decoction and the tincture of rhatany as an injection for the cure of fissure of the anus, but the applications above advised are neater and more effective.

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Colchicum.—Meadow saffron. *Colchique*, Fr.; *Zeitlose*, Ger.

Colchici Radix.—Colchicum-root. The corm of C. autumnale.

Colchici Semen.—Colchicum-seed. The seed of C. autumnale.

Preparations.—1. Of the root.

Extractum Colchici Radicis Fluidum.—Fluid extract of colchicum-root. Dose, m. ij—m. v.

Vinum Colchici Radicis.—Wine of colchicum-root. Dose, m. v—m. xxx.

Extractum Colchici Aceticum.—Acetous extract of colchicum. Dose, gr. ss—gr. ij.

2. Of the seed.

Extractum Colchici Seminis Fluidum.—Fluid extract of colchicum-seed. Dose, m. ij—m. x.

Tinctura Colchici.—Tinctura of colchicum (℥ iv—Oij). Dose, m. x—ʒ j.

Vinum Colchici Seminis.—Wine of colchicum-seed (℥ iv—Oij). Dose, m. x—ʒ j.

Composition.—Tannic and gallic acids, starch, sugar, gum, a peculiar alkaloid, *colchicia*, or *colchicine*. Colchicia is easily converted (by acids, in long-kept alcoholic preparations) into an isomeric, crystallizable body, *colchiceïn*. The amount of the alkaloid contained in the root and the seed is said to be not greater than the half of one per cent. Colchicia is not crystallizable, but combines with acids to form crystallizable salts. The conversion, in any of the pharmaceutical preparations, of colchicia into colchiceïn, does not appear to impair the therapeutical activity. That colchicia or colchicine is the active principle, is proved by the fact that the physiological effects of this alkaloid are the same as those of the crude drug (Husemann).

Antagonists and Incompatibles.—Tannic acid, by forming an insoluble tannate with the alkaloid, retards but does not prevent its absorption. When a lethal quantity has been taken, emetics and purgatives are required, and demulcents may be freely administered. Opium and the alcoholic substances antagonize the depression of the heart's action.

Synergists.—Such alkaloids as produce gastro-intestinal irritation and depress the action of the heart, e. g., *veratria*, *aconitia*, etc., are synergistic. Therapeutically considered, emetics, purgatives, alkalies, promote the activity of colchicum.

Physiological Actions.—Colchicum imparts its virtues to water, alcohol, and ether. It has a bitter taste, and excites the flow of saliva. In small doses it increases the mucous and glandular secretion of the stomach and intestines, and probably also of the liver, kidneys, and skin. If the dose be large but still medicinal, colchicum produces a feeling of epigastric heat, nausea, and vomiting, depression of the circulation, muscular feebleness, headache. It frequently purges, producing copious, watery stools, and is generally held to increase the discharge of biliary matters. It increases the flow of urine, of the solid constituents (urea, uric acid, etc.) as well as of the water, and promotes the cutaneous transpiration. In toxic doses colchicum produces all of the local as well as the systemic effects of an irritant poison, viz.: acute abdominal pain, profuse watery and choleriform discharges, suppression of urine, feeble pulse, cold sweat, coldness of the extremities. The intellect remains unaffected until carbonic-acid poisoning supervenes. The muscular cramps which have been occasionally observed are probably due to the great loss of fluid from the system. When colchicia is injected subcutaneously, gastro-intestinal inflammation is produced, showing that it has a selective action on this tissue.

THERAPY.—Colchicum is indicated when rapid wasting of tissue and prompt elimination of the products of waste are required. Its use at the present time is almost entirely restricted to the treatment of *gout* in its various manifestations. It relieves the pain, diminishes the swelling, and shortens the duration of an attack of *acute gout*. In order to accomplish these results, it is not necessary that the more harsh and violent physiological effects of the drug be produced. Sufficient quantity of colchicum should be given to increase secretion from the skin, the intestinal mucous membrane and the kidneys, but nausea and vomiting should be avoided. Combination with an alkali increases the therapeutical effect of colchicum: ℞. Spts. ammoniæ aromat., ʒ xiij; vini seminis colchici, ʒ iij. M. Sig. *A teaspoonful every three hours, until some physiological effect is produced.* The following is a formula used at the London Hospital for gout: ℞. Tinct. colchici seminis, m. xx; potassii bicarbonat., grs. x; aquæ pimentæ, ℥ j. M. Sig. *A draught.* The following modification of Scudamore's prescription is in use at University College Hospital: ℞. Tinct. colchici seminis, m. xv; magnesii carb., gr. vj; magnesii sulph., grs. xxx; aquæ menth. pip. ad ℥ j. M. Sig. *A draught.* After the more acute symptoms of the gouty attack have subsided, the following was recommended by Sir Henry Halford: ℞. Ext. colchici acet., gr. vj; pulv. opii et ipecac. comp., ext. colocynth. comp., āā gr. xij. M. ft. pil. no. xij. Sig. One pill night and morning. The efficiency of colchicum is increased by combination with digitalis: ℞. Ext. colchici acet., gr. x; pulv. digitalis, ext. colocynth. comp., āā ℈ j. M. ft. pil. no. xx. Sig. *One pill twice or thrice a day.*

The active principle, colchicia, is, there is reason to believe, more successful in gout than any of the preparations of the crude drug. ℞. Colchiciæ, gr. j; ext. colocynth. comp., ʒ ss; quiniæ sulph., ʒ j. M. ft. pil. no. lx. Sig. *One every four hours.*

In the so-called *rheumatic gout*, colchicum with alkalies is extremely serviceable. Attacks, without decided pain and inflammation, *of soreness of joints* which have been the seat of gouty attacks, or about which nodosities have been deposited, are relieved by colchicum.

Constipation, hepatic congestion, and headache, due to torpor of the portal circulation, occurring in gouty subjects, are quickly relieved by a combination of colchicum and saline purgatives. The plethoric and overfed without being gouty, suffering from the same group of symptoms, are relieved by the same means. Inflammations of internal organs occurring in gouty subjects, for example, *gouty bronchitis* and *rheumatic pneumonia,* are best treated with prescriptions containing a preparation of colchicum. The following prescription is recommended by Greenhow in gouty bronchitis: ℞. Potassii iodidi, ammonii carbonat., āā ℈j; vin. colchici seminis, ʒj; tinct. scillæ, tinct. hyoscyami, āā ʒij; aquæ camphoræ q. s. ad ℥iij. M. Sig. *A tablespoonful three times a day.*

Although colchicum is still advocated by some authorities in *acute rheumatism,* the general professional experience is against its use. In *chronic rheumatism,* when the joint changes are allied in nature to those which take place in gout, it is unquestionably serviceable. *Neuralgia occurring in gouty and rheumatic constitutions* is often relieved by colchicum. The indications for its use are plethora, constipation, and deficient excretion of the liver, kidneys, and skin. Colchicum relieves in such cases, by setting up an eliminative process. In *hepatic dropsy* and *cardiac dropsy,* when the patient is vigorous, the gastro-intestinal tract free from inflammatory mischief, colchicum may be used with advantage as a hydragogue: ℞. Elaterii, gr. j; spts. etheris nitrosi, ℥ij; tinct. scillæ, tinct. colchici, āā ℥ss; syrp. simplicis, ℥j. M. Sig. *A teaspoonful three or four times a day.* The following combination is an excellent diuretic in dropsy: ℞. Vini seminis colchici, ℥ss; sol. ammonii acetat., ℥ijss; inf. petroselin, ℥v. M. Sig. *A tablespoonful every four hours.* This prescription is well adapted to *dropsy following scarlatina.*

Colchicum is a serviceable remedy in certain *cerebral disorders.* Thus, it may be used in *acute cerebral congestion* in plethoric subjects, in *uræmic intoxication,* in *hypochondriasis,* especially when due to deficient elimination (uric acid, oxalate of lime, etc.).

The wine of colchicum-seed has frequently succeeded in curing *gonorrhœa,* and by Brodie a nightly dose of thirty minims was given for the relief of *chordee.* In the treatment of gonorrhœa, the following may be used: ℞. Vini colchici seminis, ℥ss; sol. potassii citratis, ℥vjss; tinct. opii deod., ʒij. M. Sig. *A tablespoonful three or four times a day in gonorrhœa.*

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Sarsaparilla, Sarsaparilla.—Root of smilax officinalis and other species of smilax. *Separeille*, Fr.; *Sarsaparillwurzel*, Ger.

Decoctum Sarsaparillæ Compositum.—Compound decoction of sarsaparilla. (Sarsaparilla, sassafras-root, guaiacum-wood, liquorice-root, mezereon.) Dose, ℥ j—℥ iv.

Extractum Sarsaparillæ Fluidum.—Fluid extract of sarsaparilla. Dose, ʒ j—℥ ss.

Syrupus Sarsaparillæ Compositus.—Sirup of sarsaparilla. (Sarsaparilla, guaiacum-wood, rose, senna, liquorice-root, essential oils.) Dose, ʒ j—℥ ss.

Extractum Sarsaparillæ Compositum Fluidum.—Compound fluid extract of sarsaparilla. (Sarsaparilla, liquorice-root, sassafras, mezereon.) Dose, ʒ ss—ʒ ij.

COMPOSITION.—An alkaloid, *parilline*, or *smilacine*, an essential oil, starch, resin, oxalate of lime, and extractive matters. From parilline, by the action of dilute sulphuric acid, is obtained *parigenine*, a distinct alkaloid.

ANTAGONISTS AND INCOMPATIBLES.—Alkalies favor the decomposition of the decoction and fluid extracts. As there is much starch present in the drug, free iodine should not be prescribed with the officinal preparations.

SYNERGISTS.—Iodine, mercury, and other so-called alteratives, increase the therapeutical activity of sarsaparilla. Warm clothing increases the action on the skin; diluents favor increased urinary discharge.

PHYSIOLOGICAL ACTIONS.—Much discrepancy obtains in the opinions which have been emitted in respect to the physiological actions of sarsaparilla. Surgeons generally hold to its therapeutical powers; physicians are skeptical. The physiological experiments which have been made, both with the preparations of the crude drug and with the alkaloid, have yielded negative results. Palotta's experiments, made with the alkaloid which he had discovered so long ago as 1825, indicate that eight grains of the alkaloid produce gastric disturbance, vomiting, slowing of the pulse, depression, faintness, and sweating. These results have since been in part confirmed by Cullerier. Boecker, however, making more systemic examination in accordance with modern methods, finds that sarsaparilla is devoid of physiological activity and of therapeutical power (Husemann).

THERAPY.—From the point of view of the physiological experiments it is not difficult to understand the modern incredulity in regard to the curative power of sarsaparilla. The difficulty of distinguishing between the *post hoc* and the *propter hoc* serves to account for the belief still held in some quarters, that this drug is an *alterative.* Popularly, sarsaparilla is supposed to have extraordinary powers as a "blood-purifier," and its large use at the present time arises from this belief.

Almost the only use of sarsaparilla at the present time is in the treatment of *syphilis.* It is, of course, not adapted to the primary or to the secondary forms. The experience in its favor, even of those most confident of its powers, restricts its use to the tertiary form in debilitated subjects, who have been broken down by the combined influence of syphilis, mercurialism, and iodism. It has been further demonstrated that the best effects have been obtained by the use of large doses of the compound decoction (Allbutt). As the compound decoction contains guaiac and mezereon, it is difficult to assign the exact share of the sarsaparilla in the result. Furthermore, as a pint or more of the compound decoction must be taken in the twenty-four hours, these large draughts of a warm liquid are not without influence on the functions of the skin and kidneys. It is extremely questionable whether sarsaparilla has any therapeutic power; it is not at all equal as an alterative to some of the remedies indigenous in the United States, to be considered hereafter.

The compound fluid extract, the compound decoction, and the compound sirup of sarsaparilla, are frequently used as vehicles for iodide of potassium and for the bichloride of mercury in secondary and tertiary syphilis.

Scrofula, chronic abscesses, necrosis of bones, old ulcers, and *strumous cutaneous affections,* are diseases in which sarsaparilla is supposed to be efficacious. It is more used as an adjunct to more active remedies than depended on alone.

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Guaiacum.—Guaiac. *Gayac*, Fr.; *Franzosenholz*, Ger.

Guaiaci Lignum.—Guaiacum-wood. The heart-wood of guaiacum officinale.

Guiaci Resina.—Guaiac. A peculiar resin obtained from guaiacum officinale.

Tinctura Guaiaci.—Tincture of guaiac. (Guaiac, ℥vj; alcohol, Oij.) Dose, ʒss—ʒij.

Tinctura Guaiaci Ammoniata.—Ammoniated tincture of guaiac. (Guaiac, ℥vj; aromat. spirit of ammonia, Oij.) Dose, ʒss—ʒij.

Composition.—The only constituent of interest in the wood is the *resin.* Guaiac has a complex chemical composition. It contains guaiaconic acid (seventy per cent.), guaiarec acid, guaiac beta-resin, guaiacic acid, guaiac yellow, gum, etc.

Antagonists and Incompatibles.—Spirits of nitrous ether and the mineral acids are incompatible.

Synergists.—Agents which promote cutaneous activity are synergistic. The action of guaiac is much aided by external warmth and warm diluent drinks.

Physiological Effects.—Guaiac has a very acid and pungent taste. It excites an abundant flow of saliva. In the stomach it creates a sensation of warmth and burning, increases the secretions of the gastro-intestinal canal, accelerates the action of the heart, promotes diaphoresis, and favors the production and excretion of bronchial mucus. In large doses it deranges digestion and causes gastric catarrh, and in excessive doses the series of symptoms produced by the irritant poisons, vomiting, purging, cramps, headache, giddiness, etc.

Therapy.—Formerly guaiac was in great repute as a remedy for *constitutional syphilis.* The decoction was drunk in large quantity, a very spare diet was enjoined, and the diaphoretic action of the remedy was aided by external warmth. Doubtless many cases were benefited by this mode of treatment, but the result was probably less due to guaiac *per se* than to the regimen.

Its present use as an anti-syphilitic remedy is confined to the preparations of sarsaparilla, in which it enters as a constituent.

Recent clinical experience has shown that guaiac is a capital remedy in *tonsillitis.* Given in a half-drachm dose (tincture) every four hours, it appears to abate the inflammation and to cut short the disease in a remarkable manner. It is a very acrid and disagreeable remedy, and should be given in emulsion, with mucilage or yolk of egg.

Guaiac is a useful remedy in *dysmenorrhœa,* when the pain is due to rheumatism or neuralgia, and is, of course, not adapted to those cases in which there is narrowing of the cervical canal.

Lastly, guaiac is used with varying degrees of success in *chronic gout, chronic rheumatism, lumbago, sciatica, gouty bronchitis,* etc. As we have so many more efficient and pleasant remedies for these diseases, it will rarely be necessary to resort to guaiac.

Authorities referred to:

Carter, Mr. *The Practitioner,* vol. iv., p. 190.
Flückiger and Hanbury. *Pharmacographia,* p. 92, *et seq.*

Husemann, Drs. Aug. und Theo. *Die Pflanzenstoffe*, p. 712.
Stillé, Dr. A. *Therapeutics and Materia Medica*, fourth edition, vol. ii., p. 594.
United States Dispensatory, thirteenth edition, p. 439, *et seq.*

Stillingia.—*Root of Stillingia Sylvatica.* Yaw-root, queen's root.

Extractum Stillingiæ Fluidum.—Fluid extract of stillingia. Dose, m. x—ʒ j.

(The above is the only preparation recognized by the United States Pharmacopœia. A tincture may be made of two ounces of the bruised root to a pint of diluted alcohol, of which the dose is ʒ ss—ʒ ij. A decoction may be made as follows: one ounce of the bruised root to two pints of water, boiled down to one pint, of which the dose is ℥ ss—℥ ij. All of the preparations should be made of the fresh root, as the activity of the drug is diminished by drying.)

Composition.—The plant yields on incision a milky juice, which appears to possess the medicinal properties of the drug. The so-called *stillingin* of the eclectics is not the active principle, but an extract. The active principle has not yet been isolated.

Physiological Effects.—The juice of the plant has an acrid, pungent taste, leaving a persistent after-taste of great activity. It excites an abundant flow of saliva. In the stomach a feeling of warmth follows its use, and the secretions of the organ are increased in amount. In full doses it excites nausea and vomiting, epigastric pain, and an acrid, burning sensation in the fauces. It increases the secretions of the intestinal canal, notably of the liver, and, in full doses, purges, the fæces having the appearance of the so-called "bilious stools." Increased action of the heart follows the introduction of the active principle into the circulation, and the skin becomes warm and moist. The bronchial mucous membrane exhales a larger quantity of mucus, and the kidneys become more active, excreting an increased quantity of water and solids. It may, therefore, with propriety be grouped with the so-called alteratives.

Therapy.—Stillingia is certainly a very valuable remedy. It has long had a local reputation in the Southern Atlantic States as an *alterative.*

In *habitual constipation*, due to deficient secretion of the intestinal mucous membrane, it may be used with advantage. The *torpidity of the liver* and *jaundice*, which follow attacks of intermittent fever, are removed by stillingia. This agent, also, renders important service in the first stage of *cirrhosis*, and in *ascites* due to the hepatic changes. *Hæmorrhoids*, when due to obstructive difficulty in the liver, may be removed temporarily, and, if due to constipation, may be removed permanently, by stillingia.

In habitual constipation the following formula is useful: ℞. Ext. stillingiæ fl., ʒ v; tinct. belladonnæ, tinct. nucis vom., tinct. physostigmatis, āā ʒj. M. Sig. *Twenty drops, in water, three times a day before meals.* When the biliary secretion is deficient, the following: ℞. Ext. stillingiæ fl., ʒv; tinct. aloes, ʒij; tinct. nucis vom., ʒj. M. Sig. *Twenty drops, in water, three times a day.*

Stillingia has long been in popular repute as a *blood-purifier.* It has been used in domestic practice as a remedy for *scrofula in its various forms*, and the success which has attended its employment justifies the high encomiums which have been bestowed on it. It is very serviceable in children who present the following symptoms: *enlarged cervical glands, muco-purulent discharge from the nose, with excoriations of the surrounding integument, a pasty complexion, capricious and unnatural appetite, tumid abdomen, whitish and pasty stools; dull-red, soft, and tubercular eruption on the skin, ulcerating and furnishing a large quantity of unhealthy pus.* The steady use of stillingia, combined with suitable hygienic means, will accomplish important relief in such cases.

The most satisfactory results have been obtained from the use of stillingia in *syphilitic affections.* It is applicable to the same conditions under which the preparations of sarsaparilla are now used, viz.: in chronic cases of the secondary and tertiary form, the patients having been broken down by the long-continued use of mercurials and iodides. Repeated observation of cases in which it was used as the sole agent has satisfied me of its curative value. It differs from the compound decoction of sarsaparilla in this, that its effect is distinctive, and is not due to the use merely of a large quantity of fluid. The eminent Dr. Porcher, of South Carolina, thus expresses himself with regard to the use of stillingia in syphilitic affections: "I have employed the decoction of the root of this plant as an alterative in syphilitic sores, occurring in patients in the City Hospital, Charleston, the spread of which nothing else could arrest. It proved completely satisfactory. Phagedenic chancres were rapidly cured under its use. A strong decoction was given three times a day, with four drops of nitric acid to each dose."

A strong infusion or decoction of stillingia is said to be effective in *preventing the development of a paroxysm of ague*, if taken before or just as the chill is beginning. It is reported that profuse diaphoresis is produced and the impending attack is averted. The fluid extract of stillingia may be given in combination with quinia or arsenic in intermittents.

Authorities referred to:

PORCHER, DR. FRANCIS PEYRE. *Resources of the Southern Fields and Forests*, Charleston, 1869, p. 146.

UNITED STATES DISPENSATORY, thirteenth edition, p. 838.

Sanguinaria.—Blood-root. The rhizoma of Sanguinaria Canadensis.

Tinctura Sanguinariæ.—Tincture of sanguinaria. Dose, m. v—ʒ ss.

Composition.—Sanguinaria contains an alkaloid, *sanguinarina*, which appears to be identical with the *chelerythrin* of Probst. "Sanguinarina is a white, pearly substance of an acrid taste, very sparingly soluble in water, soluble in ether, and very soluble in alcohol. With the acids it forms salts soluble in water, all of which have some shade of red, crimson, or scarlet, and form beautiful red solutions." Another alkaloid, named *porphyroxin* (sanguinaria-phorphyroxin—Husemann), has been found by Riegel, and a third by Dr. Wayne, of Cincinnati, and named *puccin*. Besides these alkaloids sanguinaria contains a peculiar acid, *chelidonic*, and another has been announced, for which the name *sanguinarinic acid* has been proposed. The alkaloids exist in the root in combination with these acids—the most important compound being the *chelidonate of sanguinarina*. Besides the foregoing, blood-root contains the following unimportant constituents: resin, gum, extractive, albumen, sugar, etc.

Antagonists and Incompatibles.—Alkalies, tannic and gallic acids, and most of the metallic salts, are chemically incompatible with the preparations of blood-root. The local irritant action of the drug and the depression of the circulation which it causes are antagonized by opium.

Synergists.—The mineral and vegetable emetics, the so-called alteratives of the vegetable kingdom, and the mineral salts, considered from the therapeutical point of view, promote the physiological and therapeutical effects of sanguinaria.

Physiological Effects.—Sanguinaria has a bitter, acrid taste, which persists for a long time. When swallowed it leaves a sense of constriction and acridity in the throat. It excites a feeling of heat in the stomach, and increases secretion of the mucous membrane. If the quantity taken is insufficient to produce nausea the action of the heart is increased, and a subjective sensation of warmth is experienced throughout the system. In considerable doses sanguinaria is an active emetic, producing much nausea and depression, and slowing the action of the heart. It is very irritating to the mucous membrane. Snuffed up the nose it produces violent sneezing. In large doses it inflames the stomach, producing intense burning with thirst, great prostration, dimness of vision, vertigo, and collapse.

The alkaloid, *sanguinaria*, manifests all the physiological capabilities of the drug. It has an intensely bitter, acrid taste. In small doses (one-twelfth to one-eighth of a grain) it simply increases secretion of the gastro-intestinal mucous membrane; in doses of one-sixth to one-fourth of a grain it causes depressing nausea and sometimes vomiting. In large doses it causes, in addition to the gastric symptoms mentioned above, slowing and irregularity of the pulse, cold sweats, cold extremities, vertigo, dilated pupils, anxiety, etc.

Applied to fungous granulations, sanguinaria has considerable escharotic power.

The sketch above given of the physiological actions of sanguinaria, which embodies the results of the author's investigations and clinical studies, requires no special modification. The recent elaborate and most thorough research of Dr. Robert Meade Smith confirms the author's account. The reader who wishes to exhaust the subject will find that nothing has been omitted by Dr. Smith.

THERAPY.—In *atonic dyspepsia* from two to five drops of the tincture, or the one-twelfth of a grain of sanguinarina, may be used with advantage. It promotes secretion, and increases the appetite. There seems no doubt, according to the author's observation, that sanguinaria promotes the hepatic and intestinal secretions. It is, therefore, a serviceable remedy in *duodenal catarrh, and secondary catarrh of the biliary ducts with jaundice.*

Its most important therapeutical effects are witnessed in *diseases of the respiratory organs. Chronic nasal catarrh* is successfully treated by the internal use of the tincture (ten drops *ter die*), or of the alkaloid (one-fifteenth of a grain *ter die*), and the local application of the powder, in small quantity, applied by an insufflator to the Schneiderian mucous membrane. In *acute bronchitis* (catarrh), after the subsidence of the more acute symptoms, it is a serviceable expectorant. It may be combined with other expectorants and alterants: ℞. Tinct. sanguinariæ, ʒ j; tinct. lobeliæ, ʒ j; vini ipecac., ʒ ij; syrp. tolutan., ℥ ss. M. Sig. *A teaspoonful, every three hours, as an expectorant.* In *humid asthma* the following combination is extremely serviceable: ℞. Tinct. sanguinariæ, ʒ j; tinct. lobeliæ, ʒ j; ammonii iodidi, ʒ ij; syrp. tolutan., ʒ vj. M. Sig. *A teaspoonful every two, three, or four hours.* In *spasmodic asthma* the same prescription is occasionally very effectual, but the author is unable to indicate the precise condition under which it is most useful.

Sanguinaria has been proposed as an *emetic in croup.* It is, however, too uncertain in action, and too harsh, to justify its use when there are so much more eligible remedies at hand.

The *emmenagogue properties* of sanguinaria seem well established. It is indicated when *amenorrhœa* is functional in character, when there is an absence of plethora, and when no malformation exists. It may be advantageously combined with aloes, provided there is no contraindication to the use of the latter. ℞. Tinct. sanguinariæ, ʒ ij; tinct. aloes, ℥ ss; tinct. nucis vom., ʒ ij. M. Sig. *Twenty drops, two or three times a day, in amenorrhœa of anæmia, or chlorosis.* Or the following: ℞. Sanguinarinæ, grs. ij; ext. aloes, grs. x; ferri redacti, ℈ j. M. ft. pil. no. xx. Sig. *One pill three times a day.*

Sanguinaria has decided *aphrodisiac properties.* When there are relaxation of the genital organs, diurnal losses, inaptitude (from irritability) for coitus, *sanguinarina* may be given as follows: ℞. Ergotin (aq. ex.), ℈j; sanguinarinæ, grs. ij. M. ft. pil. no. xx. Sig. *One, three times a day.* As stillingia appears to have similar properties as an aphrodisiac, the following combination will prove useful: ℞. Tinct. sanguinariæ, ʒiij; ext. stillingiæ fl., ʒv. M. Sig. *Fifteen to twenty drops, in water, three times a day.*

As an alterant in *chronic syphilitic* and *strumous affections*, sanguinarina may be used in the same class of cases as sarsaparilla, guaiac, and stillingia. It is an important addition to a decoction of woods indigenous to our soil, used as a substitute for the more expensive and really less efficient foreign drugs of the same group.

LOCAL APPLICATIONS.—Sanguinaria, having feeble escharotic property, is used as a local application *to repress exuberant granulations*, and to *ill-conditioned ulcers* to change their character. Several cases have been reported, indicating the power of sanguinaria to repress the growth and destroy *nasal polypi.*

A decoction of sanguinaria is a useful gargle in the *sore-throat of scarlatina.*

Authorities referred to:

HUSEMANN, DRS. AUG. UND THEO. *Die Pflanzenstoffe*, p. 199.

PORCHER, DR. FRANCIS PEYRE. *Resources of the Southern Fields and Forests*, p. 31, *et seq.*

PHILLIPS, DR. C. D. F. *Materia Medica and Therapeutics*, London, 1874, p. 143.

STILLÉ, DR. ALFRED. *Therapeutics and Materia Medica*, fourth edition, vol. ii., p. 454.

SMITH, DR. ROBERT MEADE. *The Physiological Action of Sanguinarina. The Am. Jour. Med. Sci.*, October, 1876, p. 346, *et seq.*

UNITED STATES DISPENSATORY, thirteenth edition, p. 769.

Xanthoxylum.—Prickly ash. The bark of Xanthoxylum fraxineum. United States Pharmacopœia, secondary list.

There are no officinal preparations of xanthoxylum. A decoction may be made by boiling an ounce of the bark in a quart of water down to one pint, and of this one to two ounces may be used every four hours. A tincture may also be prepared with two ounces of the root to a pint of diluted alcohol, of which the dose would be ʒss—ʒij. A fluid extract is prepared, and is more frequently in use; the dose of this is m. xv—ʒij. In prescriptions it should be designated "*Extractum xanthoxyli fluidum.*"

COMPOSITION.—Xanthoxylum contains a neutral crystallizable principle, which is known as *xanthoxylin*, and is said to be identical with *xanthopicrite*, and the latter has been shown to be *berberina.* Besides this important constituent, a volatile and a fixed oil, resin, gum, etc., are contained in it.

PHYSIOLOGICAL ACTIONS.—The taste of xanthoxylum is at first sweetish, and somewhat aromatic, but considerable bitterness is soon developed, followed by acridity, which remains long in the fauces. It has remarkable sialagogue property, and the increased flow of saliva occurs from the systemic effects, as well as the local impression on the mucous membrane of the mouth. In the stomach it excites a sensation of warmth, and increases secretion from the stomach and intestinal mucous membrane. It is in a high degree probable that just as its presence in the mouth causes salivation, so its presence in the intestinal canal determines the flow of gastric, duodenal, hepatic, and pancreatic secretion. The action of the heart is increased by xanthoxylin, the arterial tension rises, the capillary circulation becomes more energetic, and the sweat-glands are made to pour forth a more abundant secretion. Corresponding effects are produced in the kidneys, and increased flow of urine follows its administration.

THERAPY.—Xanthoxylum is a domestic remedy for *toothache.* The bark, chewed, has a popular reputation for *paralysis of the tongue.* A decoction of the bark is an efficient local application to the throat when, in cases of *chronic pharyngitis*, there is dryness of the mucous membrane. From ten to thirty minims of the fluid extract, or a half to one drachm of the tincture, is a successful remedy for an extremely obstinate affection, namely, chronic pharyngitis—the mucus adhering in large, thin, dry scales, and the mucous membrane being glossy, shining, glazed, and dry.

The active principle (xanthoxylin, really berberia) is a useful *stomachic tonic* in atonic dyspepsia. When, however, in stomach, intestinal, or hepatic disorders the object is to promote secretion, the preparations of xanthoxylum must be used. *Jaundice due to catarrh of the bile-ducts*, and that form of *jaundice produced by acute malarial poisoning*, are conditions in which xanthoxylum is distinctly remedial. *Constipation, due to deficient secretion*, is also removed by this agent.

Xanthoxylum has long had a deserved reputation in the treatment of *chronic rheumatism.* It is adapted to *muscular rheumatism, myalgia*, and such local muscular disorders as *torticollis* (recent cases), *lumbago*, etc. It may be used with advantage, locally, in these affections. The curative power which it possesses in chronic rheumatism is doubtless due to its eliminant action on the mucous and cutaneous surfaces.

Xanthoxylum is a remedy for *constitutional syphilis* of equal merit with guaiac, mezereon, stillingia, etc., and is greatly more effective than sarsaparilla.

Decoction of xanthoxylum has been used with success in the treatment of *dropsy.*

Authorities referred to :

HUSEMANN, DRS. AUG. UND THEO. *Die Pflanzenstoffe*, pp. 80, 717, 1108.
PORCHER, DR. F. PEYRE. *Resources of the Southern Fields and Forests*, p. 161.
UNITED STATES DISPENSATORY, thirteenth edition, p. 900.

AGENTS USED TO MODIFY THE FUNCTIONS OF THE NERVOUS SYSTEM.

In this division of remedies, the agents are employed with a view to their influence over the functions of the nervous system. They do not for the most part affect the function of nutrition; they do not enter into the formation of tissues; and, having modified the functions of the nervous system, they are excreted from the organism in the form in which they entered it.

The different parts of the nervous system are so closely united in function that a disturbance at any point is differentiated to other and often widely-separated points, and the complexus of effects is made up of many minor disturbances. For this reason it is quite impossible, in the present state of our knowledge, to make a classification which will sharply define the limits of activity of any particular remedy. Nevertheless, physiological experiment and clinical experience have furnished us sufficiently accurate information with regard to the most important actions of the remedies of this division, to justify an arrangement based on their most conspicuous qualities.

AGENTS WHOSE MOST IMPORTANT QUALITY CONSISTS IN EXCITING FUNCTIONAL ACTIVITY.

A.—OF THE SPINAL CORD AND SYMPATHETIC.

Electricity.—*Électricité*, Fr.; *Electricitat*, Ger.

Forms of Electrical Force employed in Medical Practice.—Static or frictional electricity, galvanic, faradic (electro-magnetic, magneto-electric).

Static or *frictional electricity* is obtained by friction from glass, as in the cylinder, plate, or Holz electrical machine. The last-named instrument is best adapted for medical use. The prime conductor of the electrical machine furnishes positive or vitreous electricity, and the rubber, negative or resinous. Various modes of electrization by static electricity are resorted to:

1. By sparks. In this mode the part to be acted on is made to receive sparks from the machine in action.

2. The electric bath. The patient is placed on an insulated stool, and is charged with positive or negative electricity from the prime conductor, or rubber, according as he is in connection with either. Sparks may be drawn from the affected part by presenting the knuckles or a metallic conductor. A sharp, tingling sensation, followed by redness

and wheals, is produced by sparks, whether received from the machine or drawn from the body.

3. By the Leyden-jar. In this method the electricity is condensed in the Leyden-jar, and the charge is transmitted through the part of the body to be acted on.

GALVANISM.—In general terms it may be stated that all chemical action is accompanied by electrical phenomena. In its simplest form a galvanic battery consists of two elements, zinc and copper, zinc and platinized silver, or zinc and carbon, for example, and an exciting fluid. The greater the difference in the chemical action of the exciting fluid on the two metals, the stronger the galvanic current. The current starts from the surface of the oxidizable metal—from the zinc of any of the above combinations—and passes through the exciting liquid to the copper, platinized silver, or carbon. This is known as the *positive* current. There is, also, a current which passes in the opposite direction—the *negative ;* but, in order to prevent confusion, the positive is alone considered. The circuit is said to be *closed* when the two metals are brought directly into contact, or through the intermediation of a connecting or *conjunctive* wire. While, in any of the combinations of elements above given, the zinc is the positive metal, it forms the negative or — pole, because the current passes from the zinc to the copper or carbon element in the battery, and from the copper or carbon element to the zinc, through the conjunctive wire. A battery is a combination of elements, and may consist of any number of elements—for medical purposes from ten to one hundred, or more. The *quantity* of electricity is the same at all points in the circuit, and depends on the amount of chemical action taking place in the battery. *Intensity* depends on the number of the elements. According to the law of Ohm, the intensity of a galvanic current is in inverse ratio to the resistance of the circuit.

Various forms of batteries are used in medical practice. The most suitable are the modification of Daniell's battery, by Remak, known as Siemens and Halske's, Smee's zinc and platinized silver, Stöhrer's zinc-carbon, Hill's zinc and copper, Muirhead's, Daniell's, Gaiffe's chloride of silver, or Grenet's sulphate of mercury. Of these, the best permanent batteries are Siemens and Halske's elements and Hill's, and the best portable battery Stöhrer's zinc-carbon combination. The following are the requisites of a good galvanic battery for medical use: It should be truly *constant ;* that is, it should furnish a current of uniform volume and tension, and not be subject to great fluctuations, rapidly rising to the maximum and then as suddenly sinking to zero. It should require but little attention to keep it in order. It should be worked with facility. The elements of Siemens and Halske, with a suitable pole or key-board to work the battery, make an arrangement which more nearly fills the requirements of a medical battery than any other.

Faradism.—This form of current differs from the preceding in that it is an *induced* current, and passes in both directions, and has very high tension. The apparatus of a faradic instrument (electro-magnetic) consists essentially of one or two cups, connected by a conjunctive coil, transmitting an *inducing current*, a secondary coil in which the induced current is excited, and a rheotome or current-breaker. The current-breaker interrupts the current in the primary coil. So long as the inducing current passes uninterruptedly, an induced current is not excited; at the moment of opening and closing the circuit, however, an instantaneous current is produced, on closing the circuit in a direction contrary to that in the conjunctive coil of the battery, and on opening the circuit in the same direction. The induced current is therefore a *to-and-fro* current.

The faradic instruments ordinarily in use furnish both a *primary* and *secondary* current.

The magneto-electric differs from the electro-magnetic in that a current is induced in the secondary coil by magnetism. By a mechanical arrangement, a coil of fine wire is made to revolve rapidly about the poles of a permanent magnet. As the galvanic current induces a magnetic condition of the bundle of wires which forms the core of the induction-coil, so the magnetic current of a permanent magnet induces an electric state of the insulated wire of the temporary magnet which is made to revolve about it. The principle of the two batteries is the same as regards the induction of an electric current, the inducing current being in the one case galvanism, and in the other magnetism.

Physiological Effects of Galvanism.—Electro-physiology has not contributed very greatly to serve as a foundation for electro-therapeutics. Nevertheless, some attention must be paid to the facts of electro-physiology, in so far as they may be utilized to explain the results obtained by the empirical employment of electricity.

The conductivity of the tissues depends upon the quantity of fluid which they contain. Bones and ligaments conduct, therefore, much less perfectly than muscles, and muscles more actively than nerves. The skin offers a strong resistance to the passage of the electrical current, and hence the utility of moistened electrodes. The current does not, as is commonly supposed, pass in right lines, but takes various curves, determined by the relative conductivity of the tissues and the degree of resistance.

Notwithstanding the brain is incased in a bony envelope, it has been conclusively shown that a galvanic current, applied to the exterior of the skull, does traverse the brain. The deepest parts of the body may be brought within the circuit. The faradic current does not have the power of diffusion and penetration possessed by the galvanic. It is not easy to localize the galvanic current to the parts between the poles or electrodes. Thus, when one electrode is placed on the nape of the neck, and the other on the sacrum, and a strong current is sent through the spine, a metallic taste is experienced in the mouth, and flashes of light appear before the eyes, due to the diffusion of the current and the excitation of the gustatory and optic nerve respectively. It is true these remote effects of the current are sometimes explained by the term *reflex*, but the phenomena are really due to secondary or *derived* currents.

Organic substances, when submitted to the action of the galvanic current, undergo decomposition. The effects are proportionate to the number and size of the elements. *Electrolysis* is the term applied to the electric decompositions. The constituents of the tissues obey the ordinary laws of electrolysis—the acids and chlorine appear at the positive pole, and the alkalies at the negative pole. The effects produced at the poles are due respectively to the acids and alkalies which appear at them, and the degree of action is determined by the amount of electricity which passes in a given time. The cauterizing action of the *anode* and *cathode*, or positive and negative poles, may be increased by introducing into the current a salt, such as the iodide of potassium, for example, the iodine appearing at the positive pole and the potassa at the negative.

Faradism and galvanism differ in their action on the circulation. In order to understand this, it is necessary to note that when a spasmodic contraction of the vessels is produced, a diminution of the amount of blood in the part takes place; on the other hand, when the organic muscular fibre acts, when stimulated, in the normal vermicular manner, the amount of blood is increased. An induction, or faradic current, causes a contraction of the arterioles by inducing spasm of the organic muscular fibre; and a continuous galvanic current, by increasing the vermicular movements of the vessels, increases the flow of blood and elevates the temperature. An interrupted galvanic current has the same effect upon the vessels as the faradic.

A current which passes from the spine to the periphery is said to be *descending*, or *centrifugal;* from the periphery to the spine, *ascending*, or *centripetal*. The direction of the current influences the results of electrical excitation. A descending current increases the amount of blood in the part by increasing the peristalsis of the arterioles; an inverse or ascending current has the opposite effect. A centrifugal current (descending) increases the afflux of blood to the uterine vessels, and favors the occurrence of the monthly flow. Also, a descending current which stimulates the organic muscular fibres of the arterioles, increases the amount of blood in the erectile tissues.

The descending or centrifugal current acts most strongly on the motor nerves, and the ascending or centripetal current affects more the sensitive nerves. The excitability of the nerves is diminished by a direct or descending current, and increased by an inverse or ascending current, whence it follows that a nerve fatigued by a descending current has its excitability restored by an ascending current, and a nerve whose excitability has been increased by an ascending current may be made to lose its excitability by a descending current. When motor nerves and muscles are brought within the circuit, the muscular contractions are strongest at the closing, whatever may be the direction of the current. An ascending current causes more energetic muscular contractions when the sensibility of the part is preserved, but, when the sensibility is diminished or abolished, the contractions are feebler. The muscular contractions, under these circumstances, are much stronger when a descending current is used. The contractions produced by an ascending current are probably reflex, or *induced* contractions.

The stronger the current, within certain limits, the more energetic the muscular contractions, and changes of intensity increase the effect according to their rapidity.

Currents of induction (faradic) differ from galvanic currents in their effects on the muscles. When the interruptions are rapid the muscle is thrown into a tetanic state; but, when slower, the contractions are momentary and successive, with intervals of relaxation. The direction of the current appears to have no influence over the results. When a mixed nerve (motor and sensitive) is stimulated by an induced current, muscular movements take place and pain is experienced. The more rapid the interruptions, the more decided are the effects. If the electric stimulation of a nerve continues for a long time, it loses its excitability.

The effects of electrical currents on the *spinal cord* may be summarized as follows:

The descending current acts on the motor nerves, giving rise to violent contractions of all the muscles of the body, and on the sensory nerves, causing pain. The ascending current increases the excitability of the cord and augments the reflex function; while the descending current has the opposite effect.

The question of the electric excitability of the cerebral hemispheres is yet *sub judice.* Hitzig, and Fritsch, and Ferrier, by a series of experiments, now well known, have apparently demonstrated the excitability of the hemispheres, in opposition to the doctrines long since laid down and universally accepted, of Magendie, Flourens, and others Hitzig and Ferrier have shown that certain parts of the brain respond in a very definite manner to electric stimulation, and in this way localization of the functions of the brain has been much advanced. In a series of electrical experiments on the brain of a woman exposed by an epithelioma, I was enabled to demonstrate the homology of the function of the brain of animals and man.

MODES OF APPLYING ELECTRICITY.—Although it is a general principle that electricity should be applied to the seat of the morbid action, it is also true that much relief is often experienced from applications to parts in which symptoms are felt. In cases of hemiplegia, for example, the best results are obtained by galvanization of the brain and faradization of the paralyzed muscles. Numerous illustrations of the same truth might be adduced.

Electrical currents are applied to parts by means of *electrodes*, connected by flexible wires with the poles—the *anode* and *cathode*—of the battery. Electrodes are of various forms and sizes, and are usually merely holders of sponge, or are pieces of steel, copper, or carbon, covered with sponge, with ebony or hard-rubber handles. When the muscles and internal organs are to be reached by the current, the sponges are moistened with warm water or a solution of salt. As has already been stated, the conductivity of the tissues depends on the quantity of water contained in them; hence, in order to overcome the resistance offered by the skin, the sponges should be well moistened. On the other hand, when it is desired to confine the electrical current to the skin itself, the skin should be rubbed dry and dusted with a drying-powder. The electrical brush, consisting of a bundle of fine wires, or of a number of flexible-wire electrodes, is often used when the current is to be confined to the skin.

To galvanize the brain one pole may be placed on the forehead, the other on the occiput, or a pole may be placed on each mastoid process, or on each temple. Whatever may be the situation of the electrodes, flashes of light, a metallic taste, and vertigo, will be experienced if the current has sufficient force to traverse the brain. From three to ten cups will usually produce these symptoms; hence, a larger number should not be used, and the applications should not continue longer than five minutes.

Dr. Beard styles that method "central galvanization" in which one pole is placed over the occiput and the other over the epigastrium, the first pole being gradually moved down over the neck and spine so as to bring the cord and the great nerve-trunks of the body within the circuit. The spinal cord is galvanized by placing one pole on the nape of the neck, and the other over the sacrum. Much has been said recently of galvanization of the sympathetic. The superior ganglion of the sympathetic may be brought within the circuit by one pole placed in the auriculo-maxillary fossa, and the other on the spinous process of the seventh cervical vertebra. Obviously, the superior portion of the pneumogastric, the spinal accessory, the cervical plexus, etc., are also included. One pole placed in the auriculo-maxillary fossa and the other on the manubrium of the sternum bring within the circuit the cervical sympathetic, the pneumogastric, the cervical plexus, etc. To stimulate the phrenic nerve, place the *anode* or positive pole on the outer margin of the sterno-cleido mastoid, near the omo-hyoid muscle, and the negative on the epigastrium. In order to electrize the ear it must be filled with warm water, and an electrode, made for the purpose, must be introduced connected with the positive pole, while the negative is applied to the mastoid process. For electrization of the eye a soft, sponge-covered electrode may be applied directly to the organ. The larynx, rectum, bladder, urethra, and uterus, may be readily reached by insulated sound-electrodes.

Muscles may be most effectively electrized by placing one pole on the belly of the muscles, and bringing the other pole in relation to the nerve-trunk supplying them. In works on electro-therapeutics these points are mapped out. Single muscles may be electrized best by Duchenne's pointed electrodes.

DIAGNOSIS BY ELECTRICITY.—By means of an electric current we determine the electro-contractility of the muscles. In health the muscles respond to the galvanic current at the opening and closing of the current, and to the rapid interruptions of the faradic current. In certain states of disease the "irritability" and the "contractility" of muscle may be increased, lessened, or destroyed. In paralysis of cerebral origin the electro-contractility is not usually impaired, and may indeed be heightened. Also, in diseases of the spinal cord, the electro-contractility is impaired or destroyed only in those muscles the nerves innervating which come off from the injured portion of the cord, and is not affected in those muscles receiving their nervous supply from a healthy portion of the cord below the seat of disease or injury. The electro-contractility is lost in muscles when the motor nerves supplying them are cut off from their origin in the spinal cord. Hence it follows that if a paralyzed muscle responds to an electrical current the lesion is not in the nerve, or in that part of the spinal cord from which the nerve takes its origin. The contractility of muscles is increased when the brain or spinal cord is in a condition of increased irritability, as occurs, for example, from recent injury, acute congestion, etc. When the electro-contractility of muscle is diminished in cases of cerebral disease, this effect is usually simply the result of disuse of the muscles, and is quickly restored by exercising them with a faradic current. Loss of electro-contractility may be due to some direct injury to the muscle, as from a blow, cold, or rheumatism—paralysis of the deltoid from a blow on the shoulder, of the muscles of the face from cold affecting the *pes anserinus* of the seventh, etc. Muscles thus affected, and incapable of responding to the faradic current, may react energetically to a slowly-interrupted galvanic current.

The sensibility to the electric current may be modified in various ways—in the skin and muscles it may be increased, diminished, or it may entirely disappear.

THERAPY.—Allbutt made a number of experimental observations at the West Riding Lunatic Asylum on the therapeutical effects of electricity (galvanism) in *psychical disorders*, and he sums up his results as follows: Marked improvement in *acute primary dementia;* distinct improvement in *mania, atonic melancholia*, and perhaps recent *secondary dementia;* no change observed in *chronic dementia* and some cases of melancholia, and an unfavorable effect in *hypochondriacal melancholia*, and, perhaps, *brain-wasting.* In the cases reported by Allbutt, the current was sent through the head and through the cervical sympathetics. Benedict (page 222) reports three cases of mental disorder improved by galvanism.

I have observed excellent results in the mental and other symptoms —*confusion of mind, impaired memory, hypochondriasis, vertigo*, etc.—which result from imperfect nutrition of the brain, caused by ætheromatous degeneration of the cerebral vessels. My method of application has consisted in transverse transmission of the current through the brain, using a current of sufficient intensity merely to cause slight giddiness, a faint metallic taste, and barely perceptible flashes of light.

Galvanization of the brain and of the cervical sympathetics is one of the measures to be resorted to in *acute active or passive congestion of the brain. Wakefulness*, when not reflex in origin, and when dependent simply on the state of the vascular supply, is often relieved by galvanization of the brain. Insomnia may be dependent on either active or passive congestion. In the first case a *continuous* current of moderate intensity should be passed through the superior ganglion of the sympathetic—the positive pole being placed in the auriculo-maxillasy fossa, the negative on the seventh cervical vertebra; in the second case a mild current should be transmitted transversely through the brain, and be slowly interrupted.

To promote absorption of the clot in cases of *cerebral hæmorrhage*, and to relieve the *collateral œdema in embolism* of the cerebral arteries, very mild galvanic currents may be employed. Caution is necessary, however, in employing galvanism in such cases. Strong currents and lengthened applications may do serious mischief; but the author believes, with Remak, that judicious application of galvanism will be useful. The immediate effects of the embolism, or of the hæmorrhage, should be allowed to subside before commencing the use of electricity, and, if there be much headache and vertigo, the greatest circumspec tion will be necessary.

In *hemiplegia* the constant current may be applied to the brain, for the purpose of improving its nutrition, and the faradic or induced current to the muscles, to prevent wasting and loss of function from disuse. If the temperature of the paralyzed parts is lowered, the skin discolored and roughened, the muscles weak and flabby, much improvement in all these particulars will follow faradization. Large electrodes, well moistened, should be used, and all the muscles should in turn be made to contract—one pole being placed over the motor nerve, the other over the bellies of the affected muscles. In cases of hemiplegia, when the nutrition of the skin and muscles has been improved to the extent which faradization can accomplish, no advantage can accrue from further persistence in the applications. In faradizing the muscles in a case of hemiplegia, a current of just sufficient intensity to cause contractions should be used. Tetanic cramps fatigue the muscles, and are harmful. The so-called "late rigidity"—the muscular contractions which ensue after a time in hemiplegia, and which occur chiefly in the forearm and hands—is best treated by a continuous current to the contracted flexors, and an interrupted or faradic current to the relatively weaker extensors.

In recent affections of the spinal cord, as a rule, electricity is not indicated. In *chronic myelitis*, *syphilitic diseases of the meninges*, after a course of suitable specific treatment, and in some of the sequelæ of *acute meningitis*, much good may be accomplished by the galvanization of the spine and the paralyzed muscles. The wasting of the affected muscles may be arrested and their nutrition raised to the normal, and the paralysis of the sphincters may, in many cases, be relieved. When the electro-contractility of the muscles is not impaired, and when they have not wasted, no good is to be accomplished by stimulating them with the electrical current.

That very troublesome disorder, *spinal irritation*, with its extensive irradiations of nerve-pain, is much benefited by an inverse galvanic current, according to Hammond, and this observation I have been enabled to confirm by my own experience. *Hysterical paralysis* of the extremities, accompanied or not with anæsthesia or hyperæsthesia, should be treated by galvanization of the spine and faradization of the muscles.

In *paralysis from lead* (dropped wrist), the muscles may be so far atrophied as not to respond to faradization, but may react when stimulated by a slowly-interrupted galvanic current. When this condition exists, the interrupted galvanic current must be first employed, and the cure be completed by the faradic current when the muscles are so far improved as to react to the latter.

The best example of a *peripheral paralysis* is that of the *muscles of the face*, from disease or injury of the facial nerve. From exposure to cold, or disease of the ear, or traumatic injury, the nerve is damaged and the muscles to which it is distributed are paralyzed. In accordance with the law already given such muscles do not respond to the faradic current, but do react to galvanism. The positive pole is placed over the *pes anserinus*, or on the mastoid process, and the negative is made to pass over the peripheral expansion of the nerve so that all the muscles innervated by the nerve are brought into action. A current of sufficient intensity to induce muscular contraction must be employed. As in the case of other peripheral paralyses, after a time the affected muscles recover their power of response to faradism, when this form of current may be used to complete the cure. If the nerve has not been irrevocably damaged, and if the paralysis has not existed so long that the electro-contractility is lost in consequence of atrophic degeneration of the muscles, a cure of facial paralysis may be effected by a persistent use of electricity.

Certain of the ocular paralyses, as of the *third*, *fourth*, and *sixth nerve*, are often cured by electricity (interrupted galvanic current). It is necessary, in order to obtain a successful result, that the remedy be employed in suitable cases. When these paralyses are dependent on cerebral tumors, syphilitic gummata, exostoses, etc., electricity cannot be expected to cure; but the paretic state of the muscles, left after the removal of the gummata, may be promptly relieved by galvanization. The functional states of the above-mentioned nerves, of which paralysis may be a symptom, will certainly be cured by electricity. Faradism may sometimes succeed when galvanism fails in these cases (Althaus).

Cases of *aphonia*, when dependent on paralysis of the vocal cords, are sometimes cured by a single application, and few, indeed, resist the proper use of galvanism. The larynx may be faradized externally; the recurrent laryngeal may be galvanized by placing one rheophore over its trunk and the other over the larynx, or, what is better, an intra-laryngeal electrode (Mackenzie's) may be used.

Paralysis of the bladder and of the *sphincter ani*, even when symptomatic of spinal affections, may be greatly benefited, and the condition of the patient rendered much more comfortable, by an interrupted galvanic or faradic current applied by suitable insulated electrodes. Idiopathic cases of these affections may be cured in this way. *Constipation*, due to atony of the muscular layer of the large intestine, can be overcome by the same means. An insulated electrode is introduced into the rectum, and a large, sponge-covered rheophore, well moistened, is passed over the abdomen so as to bring every part of the large intestine within the circuit.

The failure of respiration in *opium narcosis* can be most successfully obviated by faradization of the muscles of respiration. A strong faradic current is one of the most effective means of causing uterine contractions in cases of *post-partum hæmorrhage*.

In certain of the "*myopathies of spinal origin*," but not in all of them, electricity gives excellent results. The most decidedly curative results are obtained in *infantile paralysis*. The electrical treatment should be begun early, but after the subsidence of all inflammatory symptoms. Good results may be looked for if the electro-contractility of the muscles is not lost, and if important changes have not occurred in the joints. In many cases the affected muscles, although not atrophied, do not respond to the faradic current, but will to the interrupted galvanic. The latter should therefore be used until the muscles are put into a condition to respond to the former. Besides galvanization and faradization of the paralyzed muscles, the electrical treatment should include galvanic spinal-nerve and plexus-nerve currents. Thus far but little benefit has accrued from the electrical treatment of *progressive muscular atrophy.* If the initial change in this malady were myopathic (as asserted by Friedreich), good results from localized faradization might be obtained. The author's experience as to the curability of this disease by electricity is quite in accord with Onimus and Legros, who declare that it is without avail in this disorder. *Posterior spinal sclerosis* is equally uninfluenced as regards its course and progress by electricity, but galvanization of the spine lessens somewhat the severity of the neuralgic pains which belong to this malady.

Nothing is more certain in therapeutics than the relief to *pain* by galvanization of the affected nerve or nerves. In *tic-douloureux* decided relief to the pain is obtained by electrical applications to the fifth, and a permanent cure not unfrequently results in those cases belonging to the category of the essential neuralgiæ, so called. The best method of application is that advised by Onimus and Legros, which consists in placing the positive pole on the point of emergence of the affected nerve, and the negative over the superior ganglion of the cervical sympathetic. About ten elements of Siemens and Halske is the proper strength, and five to eight minutes the proper time, for these applications. This method of treatment is, according to Frommhold, the most effective remedy for *migraine* or *hemicrania.*

In *cervico-brachial neuralgia*, and in *sciatica*, excellent results are obtained by galvanization of the affected nerves. The positive pole should be placed over the point of emergence of the nerves from the cord, and the negative over the main divisions of the peripheral expansion. Both labile and stabile currents may be employed. A current from thirty elements will usually be required. The electrodes should be large sponges well moistened. In old cases of neuralgia, a needle such as is used for acupuncture, but insulated to near its point, may be introduced down to the neighborhood of the nerve-trunk and attached to the positive pole, while the negative sponge-electrode may be passed over the course of the nerve. This mode of galvanization is especially to be recommended in old cases of sciatica. A daily *séance* of from five to fifteen minutes is required usually in cases of neuralgia. The cure is much more difficult, and the applications must be continued over a much longer period of time, in those cases of neuralgia dependent on neuritis. Decided amelioration and even cure may be hoped for by sufficiently prolonged applications, when the nerves are so far altered that induced currents do not cause any muscular contractions. Some of the most satisfactory results have been obtained from galvanization of the uterus in uterine and ovarian nerve-pain.

In certain kinds of *muscular spasm* the galvanic current has unquestioned utility. Cases of spasmodic *wry-neck* (torticollis) of recent origin, due to "rheumatism," are quickly relieved by galvanization by stabile currents of the affected muscles, and faradization of the opposed muscles. Old cases of wry-neck and convulsive tic of the face, and writer's cramp, are not benefited by this treatment. Cases of *chorea* have been cured by static electricity, but little benefit has been derived, according to the author's observation, from galvanism or faradism.

Galvanism is sometimes of great service in *epilepsy*, but no exact indications for its use can be laid down. Obviously it can only be serviceable in idiopathic epilepsy. The applications should include the brain (transverse current from mastoid process), the cervical sympathetic, and those nerve-trunks along which an aura is transmitted.

The author has witnessed some remarkable results from the galvanization of the pneumogastric nerves, and as conspicuous failures from the same practice, in *spasmodic asthma.* Even in those cases not permanently improved, great relief to the difficult breathing is experienced when the current is passing. The positive pole is placed over the pneumogastric, beneath the mastoid process, and the negative pole is applied to the epigastrium. Faradism is not serviceable in this disease.

Exophthalmic goitre, a disease of the sympathetic system and manifested objectively by proptosis, goitre, and palpitation of the heart, is cured by galvanization of the cervical sympathetic and of the pneumogastric, and by applications to the eyes and thyroid gland.

There can be no reasonable doubt of the influence of electricity over the nutritive functions. Beard and Rockwell employ the method termed by them "general electrization," which consists in faradic applications to the surface of the body, "one pole, usually the negative, being placed at the feet or the coccyx, while the other is applied all over the surface of the body." They formulate their principles in these applications as follows: "Constitutional diseases are better treated by general, and local diseases by localized electrization." According to Benedikt—and in this view electricians are generally in accord—the true method of using electricity consists in making applications to the affected part or organs, and, to this rule may be added, to those parts or organs also in which symptoms are felt.

General electrization is useful "in those diseases that are dependent on, or associated with, impairment of nutrition and general debility of the vital functions, such as *nervous dyspepsia*, *neurasthenia*, *anæmia*, *chlorosis*, *hysteria*, *hypochondriasis*, *paralysis*, and *neuralgia* of a constitutional origin, *rheumatism* and other toxic diseases, some forms of *chorea*, and oftentimes in functional disorders of the genital, digestive, and other special organs."

In *anæmia* and *chlorosis* the usual remedies for these states may be much assisted by central galvanization, and localized applications to the vegetative organs. *Regurgitation of food*, *gastralgia*, and *feebleness of digestion*, are often signally benefited by galvanization of the pneumogastric, and by localized applications to the abdominal organs. Strong currents are needed when internal organs are to be affected by electrodes applied to the integument of the abdomen. A more effective application in these cases consists in the use of an insulated rectal electrode, while a sponge electrode of large size, and well moistened, is passed over the various organs of the abdomen. The relief of constipation by this means has already been alluded to.

Various diseases of the pelvic organs, both in the male and female, are successfully treated by electricity. *Amenorrhœa*, when dependent on atony of the ovaries and uterus, is cured by static electricity, by faradism, or by an interrupted galvanic current. A shock from a Leyden-jar may be transmitted through the pelvis, or a strong faradic or galvanic current may be applied by means of one pole on the spine, the other on the hypogastric region. In the case of married women an insulated vaginal electrode may be introduced and placed in contact with the os uteri. This is a more effective way of making the applications than by the electrodes placed externally. In *neuralgic dysmenorrhœa* the galvanic current will afford relief in a large proportion of cases; and, in *congestive dysmenorrhœa*, an inverse current will diminish the blood-supply and thus lessen suffering. The treatment of these affections should be conducted during the interval. The *chronic congestive enlargement of the uterus* is sometimes remarkably benefited by a galvanic current of moderate intensity slowly interrupted, but it is doubtful if any case of chronic interstitial metritis is ever cured, or even ameliorated, by this means.

Although the changes in the joints, induced by gout and rheumatism, may not be cured by galvanization of the central nervous system, as claimed by Meyer, yet there is no doubt that *myalgia*, *lumbago*, and other so-called rheumatic diseases of the muscular system, may be promptly relieved and cured by the constant current. The *stiffness of the joints* and the *muscular soreness* which remain after an attack of acute rheumatism are best relieved by passing a mild galvanic current through the affected parts.

Herpes, especially *herpes zoster*, and *prurigo*, when they are referable to an alteration of the cutaneous nerves, are curable by electricity. The author has seen excellent results in cases of shingles, from galvanization of the affected intercostal nerves—the positive pole being placed over the point of emergence of the nerves, and the negative brushed over the terminal filaments in the skin. Beard reports the cure of obstinate cases of *chronic eczema* by central galvanization, and his results have been confirmed by others. The author has seen a number of cases of *acne* get well under the influence of galvanization of the cervical sympathetic, and local galvanization of the skin of the face—the positive pole on the neck, the negative passed over the affected parts. It need hardly be stated that strong currents are not to be used when the poles are applied in these situations. Among the other skin-affections treated by galvanism with success are *prurigo*, *psoriasis*, and even *scleroderma;* but, as Dr. Piffard, of New York, has remarked, this method is "by no means uniformly successful." It is applicable to the treatment of the *neuroses of the skin.*

ELECTROLYSIS.—When the electrical current is made to traverse insulated needles introduced into the tissues of the body, electrolytic effects are produced, decomposition of the tissues ensues, hydrogen and the alkalies appear at the negative pole, and acids and chlorine at the positive. Remak, in his various publications, much insisted on the catalytic action of the constant current. Effusions into and about inflamed parts, and into the substance of tumors, may be made to disappear by the external application of galvanism, through moistened sponge electrodes. It is doubtful, however, whether neoplastic formations can be thus made to undergo absorption. The disappearance of effusions induces such an appearance of shrinking of tumors and inflammatory products, that actual absorption of the neoplastic material may be supposed to have occurred.

Galvano-puncture is used to remove *malignant* and other *new formations.* The sanguine expectations once entertained that cancer can be thus removed, although justified by the results in a few apparently successful cases, have not been realized. Beard proposes and has executed a new method, "working up the base," which consists in electrolytic decomposition of the subjacent parts of a cancer. A number of needles, insulated to near their points, are introduced into the healthy tissues beneath the morbid growth, and a current from twenty to sixty elements is passed through them. Decomposition ensues, and there takes place a separation of the morbid mass. As the pain of this method is great, etherization should be resorted to.

Aneurisms, so situated as to be beyond the reach of surgical interference, have been treated by galvano-puncture, but the success, although brilliant in a few instances, has not been such as to justify very sanguine expectations of its future utility. *Erectile tumors* are curable by electrolysis. *Goitre* is sometimes made to disappear by the same means. The *cysts* connected with glandular tumors in the neck may be permanently occluded by galvano-puncture. The most useful applications of this method have been made in *hydrocele,* which may be invariably cured in my experience by introducing two needle-electrodes, insulated to near their points, and passing a current from twenty to forty elements. Not less effective is the same method in the treatment of *hydatid* disease of the liver. One needle, connected with the negative pole, is introduced, and the sponge-electrode is placed at some indifferent point on the abdomen.

Spasmodic and *permanent stricture of the urethra* are treated by electrolysis, an insulated sound with a metallic tip, connected with the negative pole, being passed into the stricture, and the positive pole placed at some indifferent point. The most successful results have been obtained by Mallez and Tripier, and Dr. Robert Newman, of New York; but it is the author's observation, as also the experience of Dr. Keyes, of New York, that this method has little real utility.

Wounds and *ulcers* of an indolent character, and *bed-sores*, may be made to heal by attaching to them a galvanic couplet (zinc and silver), one of the elements remaining in contact with the sore, and the other on the skin in the neighborhood. They should be connected by a copper wire, and be confined to the parts by strips of adhesive plaster. This method has been especially serviceable in the treatment of bed-sores.

GALVANO-CAUTERY.—This method consists in cauterization by a platinum wire heated by the galvanic current. The battery used for this purpose furnishes a large quantity of electricity of low tension, hence the elements are few in number but having large surface. When a large quantity of electricity is made to traverse a platinum wire which offers great resistance, the wire is heated and may be melted. The platinum in the form of wire-loop, or dome cautery, or knife, heated by the electrical current, is the cauterizing agent. If the wire be not so highly heated as to cut through the tissues too rapidly, but little bleeding results, and a clean surface is left which promptly granulates.

It would be foreign to the scope of this work to enter into details in regard to galvano-cautery, which is a department of surgical practice. It will suffice to mention briefly the principal applications of the method. It may be used to remove *polypi*, and other *pediculated growths*, *to amputate the penis* and *cervix uteri*, to separate *hæmorrhoids*, *nævi*, *lupus*, and *carcinoma*, or to arrest *bleeding* in deep cavities, or to cauterize *sinuses*.

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Nux-Vomica.—The seeds of strychnos nux-vomica. *Noix vomique*, Fr.; *Krähenaugen*, Ger.

Extractum Nucis Vomicæ.—Extract of nux-vomica. Dose, gr. $\frac{1}{6}$—gr. $\frac{1}{2}$.

Tinctura Nucis Vomicæ.—Tincture of nux-vomica. Dose, m. j—m. v.

COMPOSITION.—Nux-vomica contains two alkaloids and a peculiar acid. The alkaloids are *strychnia* and *brucia*, and the acid *strychnic* or *igasuric acid.* The proportion of strychnia ranges from one-fourth to one-half of one per cent., and of brucia from one-eighth to one per cent. These wide differences are in great part due to the varying skill of the chemists who have made analyses. Besides these another crystallizable base has been discovered in the mother-liquor from which strychnia and brucia have been precipitated. This has been named *igasurine.* The alkaloids exist in nux-vomica in combination with igasuric acid.

Strychnia "is a white or grayish-white powder, of an intensely bitter taste, nearly insoluble in water, slightly soluble in cold alcohol, and readily soluble in boiling alcohol. When heated it melts, and by strong heat is wholly dissipated. It is but slightly or not at all reddened by nitric acid. A small portion dissolved in officinal sulphuric acid yields, on the addition of a minute quantity of bichromate of potassium, a splendid violet-color."

Strychniæ Sulphas.—Sulphate of strychnia. "A white salt, in colorless, prismatic crystals, which are without odor, exceedingly bitter, readily soluble in water, sparingly soluble in alcohol, and insoluble in ether. They effloresce on exposure to the air, and melt when heated, losing nearly fourteen per cent. of their weight of water of crystallization. By a strong heat they are wholly volatilized. Dose, gr. $\frac{1}{60}$—gr. $\frac{1}{30}$.

ANTAGONISTS AND INCOMPATIBLES.—The paralyzers, such as woorara, conium, tobacco, opium, belladonna, and physostigma, antagonize the actions of strychnia in a part of the sphere of its influence. They do not antagonize its toxic action. Chloral, tobacco, bromide of potassium, ether, and chloroform (inhaled), are its true physiological antagonists.

In cases of poisoning, tannin and the vegetables containing it should be freely administered, for the tannate of strychnia is very insoluble. Emetics, or the stomach-pump, must be used promptly. The tetanic spasms are best controlled by chloral and the inhalation of ether, or by tobacco, or by the bromide of potassium in very large doses (ʒ ij—℥ ss)

The maintenance of artificial respiration by force seems, in animals at least, to postpone the lethal action of strychnia.

SYNERGISTS.—Brucia, picrotoxine, thebaine, ergot, and, according to my own experimental investigations, belladonna, electricity, cold, etc., promote the activity of nux-vomica and its alkaloids.

PHYSIOLOGICAL EFFECTS.—The preparations of nux-vomica are extremely and persistently bitter. Like all bitters, they promote the flow of the stomach and intestinal juices, increase the digestive power, and thus favorably affect the appetite. They also hasten the intestinal movements, and the stools voided are somewhat relaxed.

The alkaloids of nux-vomica are very diffusible substances, and enter the blood very quickly. They lessen somewhat the oxidizing power of the blood, but this effect is quite insufficient to account for the physiological reactions produced in the nervous system. Small medicinal doses of nux-vomica and its alkaloid accomplish no more than other bitters, as respects the circulation. More or less plethora, slightly increased action of the heart, and, as a consequence of this condition of the vascular system, a greater energy in the performance of the various functions, result from their administration.

When a lethal dose of nux-vomica, or of its alkaloids, has been taken, characteristic symptoms follow in a few minutes. The state of the stomach as to food, the presence of tannic acid in the food, and of fat, probably, also the condition of the blood-vessels, influence the rate of absorption, and symptoms may begin in a few minutes or be delayed an hour or even longer. When a full medicinal dose has been taken, some slight shuddering, a sense of constriction of the fauces and jaws, sudden pains like electric shocks passing through the limbs, startings of some of the voluntary muscles, dilated pupils, "a meaningless smile," paleness of the face, followed by flushing and increased warmth of the surface and perspiration, are symptoms which may be produced without further development of a toxic action. If the dose be large enough to cause death, the above-described symptoms are quickly followed by tetanic convulsions, in which nearly all the voluntary muscles are engaged. When the paroxysm occurs, a shudder passes through the whole frame; the head and extremities jerk and twitch, and then, suddenly, a general tonic convulsion takes place—the limbs are extended, the hands clinched, the toes and feet incurvated, the head bent backward, the body arched and rigid, the abdominal muscles hard and tense, the respiratory muscles fixed so that the body, curved in the form of a bow, rests on the occiput and heels. The countenance assumes a ghastly grin—the *risus sardonicus*; the arrest of the respiratory movements suspends oxidation of the blood, and the skin becomes cyanosed; strong erections of the penis occur, and frequently involuntary evacuations of semen, urine, and fæces take place. Rarely does death ensue in the first paroxysm; the spasm relaxes, and nothing remains of the attack but the muscular soreness and fatigue, and the sense of impending dissolution. Absolute quiet retards the paroxysms. At first the senses are preternaturally acute, and, as the reflex function is abnormally excitable, the slightest peripheral irritation suffices to bring on the spasms. Generally patients experience comfort when the limbs are strongly held, or even rubbed, during the paroxysms; but, in the interval, absolute quiet is most grateful. The mind remains unaffected until the close, or, at least, until carbonic-acid poisoning sets in. The paroxysms rapidly succeed each other, and increase in duration and severity, death occurring usually by fixation of the muscles of respiration, or by exhaustion, and within two hours usually from the beginning of symptoms.

The remarkable similarity in the symptomatology of traumatic tetanus and strychnia tetanus requires that the points of difference between them be clearly set forth. In strychnia tetanus the jaw-muscles are not first thrown into spasm, and are not always rigid during the paroxysm ; in traumatic tetanus, trismus is one of the first symptoms. In strychnia tetanus, after the convulsion lasting from a half to one or two minutes, there is usually complete relaxation; in traumatic tetanus rigidity of the affected muscles continues. A case of strychnia tetanus goes on rapidly increasing in severity, and lasts from a few minutes to two hours; a case of traumatic tetanus proceeds more slowly, and lasts always a number of hours, and may extend over days and even weeks. And, lastly, in traumatic tetanus, the capital symptom of a wound or injury exists.

No very characteristic *post-mortem* appearances result from strychnia-poisoning. The muscles, at first relaxed, become rigid, the feet turned in, the fingers clinched, or the body may maintain the position of opisthotonos, it which it was at the moment of death. Congestion of the cerebral and spinal meninges is usually observed, and Schroeder Van der Kolk has ascertained that dilatation of the vessels and sanguineous extravasations are found in the gray matter of the cord (medulla oblongata).

The smallest quantity of strychnia which has produced a fatal result in an adult was a half-grain. Rarely can one-twelfth of a grain be given without causing muscular twitchings, and one-sixteenth of a grain has caused death in a child of between two and three years.

The effects of strychnia are exerted on the spinal cord, on the seat of the motor functions. It does not affect the functions of the motor nerves directly—the irritability of the motor nerves is not destroyed by strychnia, it is exhausted by over-stimulation. The sensory nerves are either unaffected, or their irritability is increased. The reflex functions of the spinal cord are exalted. The afferent nerves preserving their irritability, communicate impressions to the reflex centres, motor impulses are quickly originated, and the muscles through the motor nerves are fixed in a state of tonic contraction. The over-stimulation of the cord and the motor nerves exhausts the irritability of the latter. The muscles preserve their contractility.

The effects of strychnia are not limited to the nervous system of animal life: the organic nervous system participates in the perturbation. The dilatation of the pupil, the erection of the hair-follicles, the *tinnitus*, the increased heat in the limb, and the perspirations which are produced when strychnia is injected subcutaneously, indicate an influence on the sympathetic system similar in kind to that exerted on the voluntary. Experimental investigations have confirmed these clinical observations. A very considerable rise in the arterial pressure, contraction of the vessels in the frog's web, and increased action of the heart, have been experimentally demonstrated to be caused by strychnia (Sigmund Mayer).

THERAPY.—The tincture of nux-vomica is one of the numerous remedies proposed for the *vomiting of pregnancy*. It is best adapted, according to the author's observation, to those women who have a seasick feeling and who do not vomit much. Half a drop to a drop, in cherry-laurel water, or in simple water, every hour or two, is a suitable dose. Like all other remedies, nux-vomica often fails in this malady. Owing partly to its intense bitterness, and partly to its influence on the nervous system, the tincture of nux-vomica is an excellent stomachic tonic, adapted more especially to the treatment of those cases in which there is a neurotic element, as, for example, *atonic dyspepsia* and *gastralgia*. From five to ten drops three times a day before meals is a suitable dose in these cases. In *chronic gastric catarrh*, whether occurring as an independent affection, or as an accompaniment of other maladies, the tincture of nux-vomica is one of the most effective bitters. In the *gastric catarrh and morning vomiting of drunkards*, this remedy is next in value to arsenic. It may be given, advantageously, with mineral acids. The *poor appetite*, the *feeble digestion*, *and the nervousness and trembling*, which follow the sudden withdrawal of alcoholic stimulants, may be removed by frequent small doses of the tincture. To diminish the *craving for stimulants* when they are withdrawn, and *to sustain the nervous system*, the following combination is exceedingly effective: ℞. Tinct. capsici, ʒ vj; tinct. nucis vom., ʒ ij. M. Sig. *Twenty drops in water every four hours. Intestinal indigestion and flatulence* are also removed by tincture of nux-vomica.

In *atonic diarrhœa*, nux-vomica is a serviceable addition to other remedies, when a paretic condition of the muscular layer of the bowel may be presumed to exist. It is, however, more especially in *constipation* that nux-vomica is useful. It is indicated in those cases in which there are inaction of the muscular layer and, consequently, great fecal accumulations. It may be most advantageously given with purgatives in such cases: ℞. Tinct. aloes et myrrhæ, ʒ vj; tinct. nucis vomicæ, ʒ ij. M. Sig. *Fifteen to thirty drops two or three times a day.*

Nux-vomica has been signally useful in some forms of *epidemic dysentery*. It is indicated when there is depression of the vital forces, the intestines distended with gas, the stools like prune-juice. In some epidemics of *cholera*, strychnia, combined with mineral acids and opium, has appeared to be effective when the patient was about to pass into the state of collapse; and it has also been used as a prophylactic during the preliminary diarrhœa: ℞. Strychniæ sulphat., gr. ¼; acid. sulphuric. dil., ℥ ss; morphiæ sulphat., gr. ij; aquæ camphoræ, ℥ iijss. M. Sig. *A teaspoonful every hour or two, well diluted.* This combination is also effective in *summer diarrhœa*, when the evacuations are very watery, and in *colliquative diarrhœa.* When there is much pain, the quantity of morphia may be increased, or the first dose may be doubled. When the character of the case is such as to require continued use of the prescription, of course, the quantum of strychnia must be lessened.

Nux-vomica and its alkaloid strychnia are much used in combination with restorative remedies, in cases of impoverished blood—in *anæmia*, *chlorosis*, *hæmorrhagic diathesis*, *purpura*, etc. In anæmia and chlorosis strychnia is used with reference to its power to stimulate the blood-making organs, which functionate under some special influence proceeding from the nervous system. ℞. Ferri sulph. exsic., ℈ij; quiniæ sulph., ℈j; strychniæ sulph., gr. ss. M. ft. pil. no. xx. Sig. *One pill three times a day.* No prescription is more generally useful in these states than the sirup or elixir of iron, quinia, and strychnia, a formula originally proposed by Aitken.

In the treatment of *amenorrhœa*, the preparations of nux-vomica and strychnia frequently enter into the composition of prescriptions. In *post-partum hæmorrhage*, Fordyce Barker prescribes the tincture of nux-vomica (twenty drops), and fluid-extract of ergot (thirty drops), "every half-hour until well assured that the uterus is well contracted." It is obvious that not more "than two or three doses" of such strength will be safe. The neuralgic form of *dysmenorrhœa* may be permanently removed by nux-vomica given during the interval.

When *impotence* is due to mere relaxation and atony of the erectile apparatus, and is not dependent on organic defects, the preparations of nux-vomica are indicated and are useful. *Incontinence of urine*, when due to a paralytic state of the sphincter, may sometimes be cured by strychnia. *Nocturnal incontinence*, which is most successfully treated by belladonna, ergot, and iodide of iron, is sometimes not relieved by these agents, when strychnia may be tried. The author cannot state with precision the cases in which it succeeds, but it has appeared to him most successful in those cases dependent on simple atony of the bladder, associated with general laxity of fibre.

The most important uses of nux-vomica and its alkaloids are in the treatment of nervous affections, chiefly in *paralysis*. It may be used with advantage in *hemiplegia*, when sufficient time has elapsed to permit repair of the damage done by the extravasation. It is improper to use strychnia during the period of "early rigidity," and it is without avail in cases of "late rigidity" of the paralyzed members. It is most useful when the paralyzed members are completely relaxed. It is useless when the paralysis has existed so long that the muscles have undergone fatty degeneration, so that they no longer respond to a faradic or slowly-interrupted galvanic current. Even if the necessary conditions as respects the state of the muscles are present, strychnia is inadmissible in cases of paralysis of cerebral origin when there are vertigo, headache, and *tinnitus*.

In *paraplegia of reflex origin*, in *rheumatismal paraplegia*, in *syphiloma of the spinal meninges*, paraplegia continuing after the removal of the deposits, strychnia is a most serviceable remedy.

The best results are obtained from the use of strychnia in *local paralysis, in lead-colic and constipation, and in drop-wrist, in mercurial and paludal palsies, in rheumatismal paralyses*—for example, *facial paralysis*, from exposure of the face to cold—*torticollis, spinal curvature, from paresis of the muscles on one side*, etc.

In certain forms of spasms strychnia sometimes achieves most important results. The evidence which has been accumulated as to the curative power of strychnia in *tetanus* is certainly very conclusive. In this disease it should be given so as to substitute the strychnic for the traumatic tetanus, but the symptoms induced should not exceed those due to a *full medicinal dose*. Strychnia is most successful—as indeed are all the appropriate remedies—in the more chronic cases of tetanus, and in those of spontaneous rather than traumatic origin.

Trousseau's experience is strongly in favor of the use of *strychnia* in the treatment of *chorea*. The method which he has pursued does not commend itself—it is heroic, and indeed unsafe. It consists in the use of such doses, beginning with one dose a day and increasing them until stiffness of the muscles of the neck, spasmodic jerkings, and a "meaningless smile," indicate the beginning of strychnic poisoning.

Strychnia is a very serviceable remedy in *idiopathic* or *essential epilepsy*. It is adapted to pale, anæmic young subjects who have the *petit mal*, as well as the *grand mal*, and whose attacks are nocturnal. It exerts no influence but an injurious one over symptomatic epilepsy—that dependent on "coarse organic lesions of the brain." It is said that the state of the retinal circulation furnishes an indication for strychnia or bromide of potassium, fullness of the retinal vessels being an indication for the latter agent, and pallor and anæmia for the former.

In that functional irritability of the nervous system manifested by restlessness and *wandering neuralgic pains*, strychnia affords relief.

Spasmodic asthma of nervous subjects, when the paroxysms are due to an irritable state of the nervous system, are associated with vague neuralgic pains, and are determined by psychical influences, may be so far influenced by the persistent use of strychnia as to occur much less frequently.

Amaurosis of a functional kind, from lead, tobacco, and alcohol, may be cured by strychnia. Paralysis of the ocular muscles (prosopalgia), of the muscle of accommodation, and paralysis of a single muscle, when these affections are due to an arrest of function of the nerve or nerves, and do not involve changes of structure, are curable by strychnia. Nagel, however, reports a cure of amaurosis in which there existed white atrophy of the optic disks!

Nux-vomica has been used with success in the treatment of *intermittents*. At present it is rather employed as an adjuvant to quinia, than relied on as the sole curative agent.

HYPODERMATIC INJECTION OF STRYCHNIA.—This important therapeutical measure needs to be separately discussed. The solution which the author advises is as follows: ℞. Strychniæ sulphat., gr. ij; aquæ destil. vel aquæ lauro-cerasi, ℥ j. M. Sig. *Five minims contain one-forty-eighth of a grain.* Some heat is usually necessary to procure a perfect solution.

"The effects of strychnia," as has been well remarked (Echeverria), "are widely different when administered hypodermically or by the mouth. By the latter method the quantity may be repeated and increased, unsuccessfully . . . . and yet a smaller dose of the substance, exhibited hypodermically, be capable of regenerating at once the lost muscular power."

The indications for the subcutaneous use of strychnia are precisely as those given above for its stomach administration: it is contraindicated in cases of hemiplegia when the injury to the brain has been recent. It generally does no good, but harm, when the paralyzed muscles are rigid. It is most useful in old cases of hemiplegia, the subjects not being advanced in life, the paralysis incomplete, the muscles flaccid but not wasted, and having preserved their electro-contractility. Very remarkable improvement not unfrequently follows from this mode of treatment in suitable cases.

The hypodermic injection of strychnia not unfrequently is entirely successful in curing *paraplegia*, but the limits of its utility are well defined. It is not proper, and is in every way injurious, in acute cases involving structural alterations of the spinal cord. In doubtful cases, a strychnia-injection may be used as a means of diagnosis between structural and functional diseases of the cord; in the former, the symptoms are increased in definition; in the latter, they are ameliorated by the injection. This mode of using strychnia is curative in *reflex paraplegia*, in *paraplegia due to anæmia of the cord*, in *hysterical paraplegia*, and in those cases of paresis of the muscles of the inferior extremities due to concussion of the cord, to rheumatism of the meninges, and to syphiloma, after the local morbid process has ceased.

In *infantile paralysis*, the hypodermatic injection of strychnia is an important addition to other means of treatment. If the electro-contractility of the affected muscles is not lost, very beneficial results may be expected: the injection promotes the capillary circulation, and increases the growth and power of the muscles.

In no form of paralysis is the use of strychnia more conspicuous for good than *diphtheritic paralysis*. Few cases are not promptly benefited and most are quickly cured. The utility of the subcutaneous injection of strychnia has been most signally exhibited in the *local paralyses*; e. g., *facial paralysis*, *aphonia from paralysis of the vocal cords*; *paralysis of the extensors by lead*; *paralysis of the sphincter vesicæ*, *of the sphincter ani*, etc.

The mode of practising the injection is of considerable importance. The solution should be thrown into the substance of the paralyzed muscles. For example, in hemiplegia, the muscles in turn, of the paralyzed side, should be pierced by the needle, and the solution discharged into them. In drop-wrist the extensors should be grasped, made tense, and the needle of the syringe be thrust well into them. In paralysis of the sphincter ani and prolapse of the bowel, the muscle affected should be penetrated by the needle. When the affected muscles are beyond reach, the injection may be practised at any indifferent point.

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Picrotoxine.—A principle found in cocculus Indicus.

ACTIONS AND USES.—Picrotoxine is not an alkaloid, although allied to this group of substances. It does not combine with acids to form salts; but it crystallizes in needles. It is soluble in water to some extent, and dissolves freely in alkaline solutions. As picrotoxine in solution is unaffected by metallic salts, tannin, etc., its range of pharmaceutical combination is wide.

The taste of picrotoxine is bitter. It excites irritation of the gastro-intestinal mucous membrane, and causes nausea and vomiting. As a crystalloidal substance, it diffuses rapidly into the blood. Its chemical relations and affinities are such that it probably does not affect the composition of the blood. It is actively toxic, its effects being expended chiefly on the cerebro-spinal axis. The symptoms produced by it on the brain are hebetude of mind, stupor, delirium, hallucinations, coma, etc.; on the spinal cord, exaltation of its reflex function, convulsions, partly clonic, but more especially tonic in character, similar to those caused by strychnia, trembling, incoördination, etc. The tetanic cramps produced by picrotoxine differ from those caused by strychnia, in that the latter affect more exclusively the extensors. It has been well said that the convulsions of picrotoxine more resemble the choreic; those of strychnia, more the tetanic (Gubler); the tetanizing action of picrotoxine has, also, been referred to an impression on Setchenow's inhibiting centre of reflex movements.

Picrotoxine has lately been proposed as a remedy for *epilepsy* (Hammond). It is especially adapted to the cases characterized by anæmia, and to those in whom the attacks occur in the night. Gubler proposes its use in *chorea.* What Trousseau has shown for strychnia in chorea is equally true of picrotoxine: to be curative it must be administered in doses large enough to produce some characteristic effects.

Picrotoxine will doubtless be found useful in the treatment of *paralysis;* but the limitations which govern the employment of strychnia in the same case sare equally necessary. According to Tschudi, this agent is especially useful *in paralysis of the sphincters* (Husemann). It may be administered by the stomach, or hypodermatically; in the former case, in pill-form; in the latter, in solution in water—the injection being made into the paralyzed muscles. The tremors of *alcoholic excess* may be diminished or removed by small repeated doses of picrotoxine. This is also one of the numerous remedies for *headache,* being more especially adapted to the cases of sick-headache occurring periodically.

An ointment of cocculus Indicus has long been considered an efficient remedy in *parasitic skin-affections.* In the preparation of this ointment, picrotoxine is now usually employed in the proportion of ten grains to the ounce. Such a preparation must not be applied to an abraded surface.

For hypodermic use, the dose of picrotoxine will range from $\frac{1}{60}$ to $\frac{1}{20}$ of a grain—the larger quantity for adults and those whose physiological capacity has been tested. By the stomach, the dose may vary from $\frac{1}{30}$ to $\frac{1}{15}$ of a grain.

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Ergota.—Ergot. The sclerotium of claviceps purpurea, replacing the grain of secale cereale. *Ergot de seigle*, Fr. ; *Mutterkorn*, Ger.

Extractum Ergotæ Fluidum.—Fluid extract of ergot. Dose, ʒ ss — ℥ j.

Vinum Ergotæ.—Wine of ergot. Dose, ʒ i— ℥ ss.

Ergotin.—This preparation must not be confounded with a constituent of ergot, supposed to be an active principle. The ergotin of the shops is simply an aqueous extract. It varies very much in strength, owing to faulty modes of preparing it, and, as found in the shops, is not unfrequently inert. As prepared by Squibb it is entirely soluble in water, and represents the powers of the drug. Ergotin is the most eligible preparation for hypodermatic injection. From one to five grains may be injected at one time. In preparing it for this purpose, the quantity to be injected should be rubbed up with fresh distilled or rain water, and then passed through the filter. It is always better to prepare it whenever required. If it is necessary to preserve the solution, the addition of a little carbolic acid—one grain to four ounces —will usually suffice. The addition of glycerine is not necessary, unless added as a preservative fluid; and is objectionable, because it greatly increases the pain which attends the subcutaneous injection.

COMPOSITION.—Ergot contains about thirty per cent. of a saponifiable, non-drying oil, with which is associated a small quantity of resin and cholesterin. The oil consists of oleine, palmitine, acetic and butyric acids, and glycerine. Two active principles, *ecbolina* and *ergotina*, and a peculiar acid (*ergotic acid*), are found in ergot. According to some authorities, ecbolina possesses in a high degree the physiological activity of ergot; according to others, it is inert. A similar discrepancy of opinion exists in regard to ergotina, and it is probable that the peculiar qualities of this drug are due to a combination of action of its constituents. When the extract of ergot is treated with an alkali, a peculiar, fishy odor is developed, due to *methylamine* according to some authorities, and *trimethylamine* according to others. This does not exist preformed, but is the product of the decomposition of the albuminoid matters contained in ergot. Ergotine, the alkaloid, must not be confounded with the aqueous extract of Bougeau, to which he, unfortunately, gave the name ergotine.

ANTAGONISTS AND INCOMPATIBLES.—The caustic alkalies and the metallic salts are chemically incompatible. Aconite, veratrum viride, tobacco, lobelia, etc., antagonize the action of ergot on the circulation.

SYNERGISTS.—Electricity, cold, digitalis, belladonna, are synergistic as regards the vascular system. Savin, gossypium, rue, borax, increase its parturient action.

Ustilago Maidis.—Corn ergot.

COMPOSITION.—There is a great similarity in the composition of this substance and the ergot of rye. An important constituent is *propylamine*, and it contains also the so-called *secalin*, a thick, viscid oil, resin, and some other unimportant ingredients.

As it corresponds to ergot of rye in its chemical constitution, it is in a high degree probable that it possesses similar physiological effects.

PREPARATIONS.—The most eligible preparation is the fluid extract.

Extractum Ustilaginis Maidis.—Fluid extract of ustilago. Dose, m. xx—ʒ ij. Each minim is equivalent to one grain of the crude drug.

The clinical evidence is strong that the corn ergot possesses the same properties as the rye ergot, and is applicable to and has been used in the same forms of disease. If further experience confirms these observations, a most desirable addition to the resources of the materia medica will be made. It occurs in larger quantity, is more readily obtained, and will be less sophisticated than the corresponding rye preparation.

PHYSIOLOGICAL EFFECTS.—In small medicinal doses ergot does not produce sensible physiological effects. In large doses it produces symptoms referable to the gastro-intestinal canal, and to the cerebro-spinal axis. It is bitter to the taste, and excites more or less heat and dryness of the throat, followed by thirst, stomach-pain, vomiting, intestinal pain, and occasionally purging. These gastro-intestinal symptoms are unquestionably due to the local irritant action of the drug; for, after death, in the few fatal cases which have resulted from its administration, there have been found patches of inflammatory redness in the stomach and intestines.

The active constituents of ergot diffuse into the blood. What changes, if any, are caused in the composition of the blood, are at present quite unknown. Very characteristic effects are, however, produced in the circulatory system: the action of the heart becomes slower, and an enormous rise takes place in the blood-pressure. This influence on the circulatory system modern research has shown to be due to the action of ergot on the vaso-motor nervous system; it increases the action of this system, and causes a contraction of the arterioles.

The dilatation of the pupil which follows is another evidence of this action. Pain in the head (usually frontal), dimness of vision, giddiness, and stupor, are also produced by it. The action of ergot on unstriped muscular fibre is further shown in the contractions of the parturient womb, the arrest of hæmorrhage, and the difficulty of micturition, which follow its medicinal administration. The power of ergot to contract the arterioles has been repeatedly demonstrated in the web of the frog's foot.

The phenomena above described, due to the administration of large medicinal or toxic doses, are known as *acute ergotism*. The peculiar morbid effects of ergot, when used for a long period of time as food (diseased grain), are known as *chronic ergotism*, which exists in two forms, the *convulsive* and *gangrenous*. Generally the convulsive form begins by vertigo, disorders of vision, *tinnitus aurium*, numbness of the fingers and toes, and afterward of the integuments of the body. These symptoms are followed by tetanoid contractions of the fingers, of the forearms or the arms, and of the arms against the chest; of the toes on the palmar surface of the foot, of the leg on the thigh. The thoracic, abdominal, and diaphragm muscles are also tetanically contracted, and respiration becomes painful and difficult, and attacks occur similar to asthma. The intestinal muscles become affected by cramp, doubtless tetanoid in character, colics ensue, and diarrhœa; the uterus in pregnant females takes on action, and abortion may result. The pulse is small, action of heart slow, and the surface cold. The appetite is generally ravenous.

The tetanic spasms, at first separated by distinct intervals, become continuous, and opisthotonos or emprosthotonos is produced. Anæsthesia (complete) of the surface succeeds to the tetanoid attacks, and gangrene of limited spots may occur. The organs of sense lose their sensibility and taste, hearing and smell are abolished. The pupils are dilated, sometimes unequal, and various disturbances of vision ensue. Epileptiform convulsions may occur in addition to the tetanoid spasms, delirium sets in, and complete insensibility at last supervenes.

As has been shown by Lasègue and Tardieu, the gangrenous and convulsive forms of chronic ergotism are not separated by any well-marked pathological differences. The gangrenous form begins by tingling, numbness, formication, an insupportable sense of fatigue in the members, an earthy hue of the skin, coldness of the surface; nausea, vomiting, and diarrhœa, with intestinal cramps, then occur; muscular contractions take place; an eruption of vesicles filled with a dark ichorous fluid appears on one or more extremities, and gangrene, dry or moist, quickly destroys the toes, the legs, the nose, or other parts.

The phenomena of chronic ergotism are evidently due to two causes —to the dyscrasia which exists in the subjects of this malady, owing to insufficient food and bad hygienic surroundings, and to the action of the ergot of the diseased grain, in diminishing the blood-supply to the cerebro-spinal axis, to the vegetative organs, and to the skin and muscular system.

THERAPY.—The only diseases of the intestinal canal to which ergot is applied, are *chronic diarrhœa and dysentery.* It is best adapted to those cases in which the chronic succeeds to the acute form, and is not so serviceable in the chronic diarrhœa of warm climates, which has developed slowly, without preliminary acute symptoms. ℞. Ext. ergotæ fluidi, ℥iijss; tinct. opii deodor., ℥ss. M. S. *A teaspoonful three times a day.* ℞. Ergotinæ (aq. ex.), ℈j; ext. nucis vomicæ, gr. v; ext. opii, gr. x. M. ft. pil. no. xx. Sig. *One every four or six hours.* The last-mentioned prescription is highly useful in persistent chronic diarrhœa.

Ergot in the form of the fluid extract, with or without nux-vomica, will often arrest the bleeding of *hæmorrhoids*, and cause such a contraction of the vessels in recent cases as that the symptoms may entirely disappear. This treatment is especially serviceable in the hæmorrhoids which succeed to delivery. *Relaxation of the sphincter ani* and *prolapsus of the rectum* may be ameliorated and, when recent, cured by the same means.

Ergot is a useful remedy in cases of *enlarged heart* (dilated cavities) *without valvular lesion.* It may be given with digitalis: ℞. Ext. ergotæ fluidi, ℥iijss; tinct. digitalis, ℥ss. M. Sig. *A teaspoonful three times a day.* There is now no longer any doubt as to the value of ergot in *aneurisms*, and especially in internal aneurisms beyond the reach of surgical treatment. In these cases the *methodus medendi* is as follows: ergot slows the action of the heart, and causes such a degree of contraction of the arterioles as to produce a great increase of the blood-pressure, whence it follows that the coagulation of the blood in the aneurismal sac is greatly promoted. It is quite conceivable that, as respects small aneurisms of the peripheral main arterial trunks, ergot may effect a cure in the mode suggested by Langenbeck, viz., by direct contraction, under the influence of the ergot, of the unstriped muscular fibres in the affected portion of the vessel. With the use of ergot should be enjoined rest in the recumbent posture, and other measures to favor hyperinosis and the coagulation of the blood in the aneurismal sac.

The recent, more accurate notions, regarding the physiological action of ergot, have led to its employment in various forms of *hemorrhage.* With suitable means for improving the quality of the blood, ergot is very serviceable in the *hæmorrhagic diathesis;* but it is not to be relied on alone. The special indication for its use in hæmorrhage is a want of tonicity of the vessels. It is used in *epistaxis*, *hæmoptysis*, *renal*, *intestinal* and *uterine hæmorrhage.* Large doses of a suitable preparation are necessary; for, if the drug be inert, nothing but disappointment will be experienced from its use, and small doses do not produce sufficient effect. From half a drachm to a drachm of the powdered ergot, or one to two drachms of the fluid extract, given every half-hour or hour, will be necessary in urgent cases. As powdered ergot rapidly loses its activity by keeping, the fluid extract should be used, and only that prescribed which has been carefully made from the fresh drug. Attention to these precautions will insure more uniform results in *hæmorrhage* than have hitherto been obtained. In *hæmoptysis* the fluid extract of ergot may be given with other appropriate remedies: ℞. Ext. ergotæ fluidi, ℥ iij; ext. ipecac. fluidi, tinct. opii deodor., āā ℥ ss. M. Sig. *A teaspoonful every half-hour or hour.* When the sputa are heavily charged with blood, and there is no defined hæmorrhage, the following may be used: ℞. Ergotinæ (aq. ex.), ℈j; pulv. ipecac., gr. x; acid. gallic., ℈j. M. ft. pil. no. xx. Sig. *One every hour or two.* In *renal hæmorrhage*, the following is a useful formula and generally very effective: ℞. Ext. ergotæ fluidi, tinct. krameriæ, āā ℥ ij. M. Sig. *A teaspoonful every hour or two.* Or, ergotine may be prescribed with gallic acid, as in the prescription above given.

The indication for the use of ergot in *menorrhagia* is the existence of large, spongy uterus—the condition of things which depends on *subinvolution of the womb.* Menorrhagia, when caused by ovarian excitement, is usually more promptly relieved by bromide of potassium, and *metrorrhagia*, produced by fibroids or fungous granulations, is, in the author's experience, much more decidedly held in check by diluted sulphuric acid than by ergot.

When there is reason to believe that *vertigo*, *epistaxis*, *headache*, and *tinnitus aurium*, are due to *miliary aneurisms* of the inter-cranial arterioles, most favorable results can be produced by the use of ergot. Also, when there is a sluggish and partially obstructed state of the intra-cranial veins, usually due to chronic arteritis, and accompanied by hebetude of mind, giddiness, epistaxis, etc., these symptoms are made to disappear, and the mental condition is much improved by ergot.

Dr. Crichton Browne, a physician of large experience in these disorders, finds ergot a very useful remedy in certain forms of *mental disease*, for example, "in *recurrent mania*, *chronic mania with lucid intervals*, and in *epileptic mania.*" In these mental disorders he assumes the existence of cerebral hyperæmia, and he deduces the curative value of ergot from its power to cause contraction of the vessels.

Migraine, when the attacks are accompanied by suffusion of the face, injected conjunctivæ, and a full pulse—the congestive form is cured by ergot, and Dr. Kitchen indeed extends its use to almost all kinds of *headache.*

In *epidemic cerebro-spinal meningitis,* ergot is one of the remedies from which the best results are to be expected. In *congestion of the spinal meninges and the cord,* and in *acute myelitis,* this remedy has probably been more uniformly successful than any other, but it must be given in large doses.

Excellent results have been obtained from the use of ergot in *acute inflammation of the conjunctiva,* in *blepharitis,* and in the *phlyctenular ophthalmia* of children.

The long-continued use of ergotine has achieved remarkable results in *chronic metritis. Uterine fibroids* and *polypi of the uterus* are greatly benefited in two modes by ergot: uterine action is set up, by which the growth is either compressed or extruded, and the nutrient vessels are so diminished in calibre that atrophy of the morbid growth occurs. The numerous reported instances of success by this treatment, and the author's personal experience of its utility, justify him in urging a trial of this remedy in uterine fibroids and polypi.

In *congestive dysmenorrhœa,* much good may be expected from the use of ergot when the menstrual molimen begins. ℞. Ext. ergotæ fluidi, ʒ vij; tinct. gelsemii con., ʒ j; tinct. aconiti rad., gtt. xvj. M. Sig. *A teaspoonful every two, three, or four hours. Amenorrhœa, when dependent on plethora,* has been cured by ergot.

When *incontinence of urine, nocturnal or diurnal,* is caused by a paretic or paralytic state of the *sphincter vesicæ,* relief may be confidently expected from the use of ergot. The fact that one of the ill-results of the administration of ergot in large doses is an inability to void the urine, is an interesting explanation of the *methodus medendi* of ergot in these cases.

Ergot is one of the most satisfactory remedies in the treatment of *spermatorrhœa.* It is not useful when the losses are due simply to plethora. Its curative value is especially exhibited in those cases in which the erections are feeble and infrequent, the intromittent power wanting, and the testes relaxed and deficient in secretory activity.

Paralysis of the bladder, the result of over-distention, and occasionally when due to cerebral or spinal lesion, is greatly benefited or cured by ergot.

It is said that the *toxic symptoms caused by carbonic oxide* are speedily removed by ergot, but the author is aware of no case in which the results of experiments on animals have been confirmed by observation on man.

Ergot in Obstetric Practice.—It is no longer a matter of doubt that ergot promotes uterine contractions; that it originates them without previous effort of the womb, is questionable. The contractions due to ergot differ from the spontaneous, natural contractions, in being less rhythmical and more tetanic. When large doses of ergot are used, a continuous expulsive effort may be produced. Ergot is indicated in labor when there is *uterine inertia*, the first stage being completed, and no obstacle existing at the outlet. If given before dilatation is completed, the perinæum rigid, and the *ostium vaginæ* not relaxed, disastrous consequences may ensue, both to mother and child. On the part of the mother, the violent and continuous pains—the resistance in front remaining—may cause a rupture of the womb, or the resistance may be overcome by laceration of the perinæum. On the part of the child, it arrests hæmatosis, partly by direct action on the placental blood, and partly by the continuous compression of the body; but the chief danger is paralysis of the fœtal heart.

It is highly approved by obstetricians at the present time to administer a dose of ergot at the conclusion of the second stage of labor, to insure firm uterine contractions. This practice is held to be the more necessary when previous experience justifies the apprehension of troublesome hæmorrhage. When *post-partum hæmorrhage* occurs it is universally conceded to be the proper thing to administer a full dose of ergot; but at the same time other measures must be resorted to in order to procure firm uterine contractions, on which alone depends the safety of the patient. In these conditions the ergot is usually administered in substance—one scruple to a drachm, of coarsely-powdered ergot, infused in a cup of hot water, the whole being drunk by the patient. From ʒ j to ℥ j of the fluid extract may be given instead—the officinal preparation representing a grain of ergot to the minim.

THE HYPODERMATIC INJECTION OF ERGOTINE.—The subcutaneous injection of ergot has become so important a therapeutical resource that it is necessary to treat the subject in a separate division. The solution employed for this purpose is usually as follows: ℞. Ergotinæ (aq. ex.), ʒ j; glycerinæ, ʒ j; aquæ destil., ʒ vij. M. Sig. *Eight minims contain one grain of ergotine.* Squibb has prepared "an extract of ergot which is almost entirely soluble in cold water, and represents good rye ergot in the proportion of one grain of extract for five grains of ergot. Sixty grains of this extract, dissolved in two hundred and fifty minims of water—the solution filtered, and made up to three hundred minims by passing water through the filter to wash it and the residue upon it—makes a solution which represents ergot in the proportion of minim for grain, and is of the same strength as the fluid extract of ergot, but is free from alcohol or other irritant substance." When the aqueous extract of ergot of good quality cannot be obtained, the fluid extract may be used.

The rules for the administration of ergot are the same as for other agents applied in this way.

In the treatment of *hæmorrhage*, when a prompt effect is desired, the hypodermatic injection is preferable to the stomach administration.

In *hæmoptysis*, the injection may be practised while suitable remedies are administered by the stomach. In *hæmatemesis*, especially if the stomach be irritable, better results may be obtained by subcutaneous use of ergotin than by any form of intestinal medicine. In *post-partum hæmorrhage*, when to await the action of ergot may endanger the life of the mother, the subcutaneous administration should be resorted to. The happy results which have attended this mode of administration, in serious cases, demand that the accoucheur be provided with the necessary appliances for the hypodermatic injection of ergotine in every obstetrical case. This mode of using ergot is not only prompter in results but is more effective in securing uterine contractions and arrest of hæmorrhage.

The good results which are obtained from the stomach administration of ergot, in *subinvolution of the uterus* and in *chronic metritis*, are much more quickly and decisively obtained from the subcutaneous administration. Since the memoir of Hildebrandt appeared, numerous cases of successful treatment of *uterine fibroids* by hypodermatic injection of ergotine have been published. There seems to be no longer any doubt that this agent administered in this way, and less effectively and for a much longer period by the stomach, also has the the power to arrest the growth of uterine fibroids, to cause them to atrophy, or to set up such a degree of uterine action as to compel their extrusion as polypi from the uterine cavity. It has, of course, long been known that ergot administered by the stomach may induce such a degree of uterine contraction as to expel a polypus. In those instances in which the hypodermatic injection fails to arrest the growth of a polypus, notable improvement in the amount of the hæmorrhage and of the muco-purulent discharge is, at least, a result of the treatment. The author is enabled to speak from personal observation of the excellent results obtained by this mode of treatment in many cases.

From two to six grains of the aqueous extract of ergot (ergotine) may be injected under the skin in these cases of uterine fibroids on alternate days, or thrice or twice each week. The abdomen is usually preferred as the site of the injection. More or less pain is experienced at the moment of the insertion of the solution, and an indurated spot, which may be more or less sore, will remain for a week or more. Suppuration may result from the injection, but it is not a frequent accident.

The hypodermatic injection is an effective mode of treating *varicocele*. About two grains of ergotine in solution is a suitable dose. The needle is inserted so that its point will rest among the dilated veins, but care must be taken not to puncture a vein. Very severe pain follows, and there may be great faintness, but the effects subside in a few hours unless considerable swelling should ensue, which is quite usual. A single injection may cure a very extensive varicocele, and more than two are rarely necessary. *Varicose veins* in other parts, especially of the inferior extremities, have been cured by the same treatment. The following is the mode of proceeding in these cases: the needle is inserted under the skin, in close juxtaposition to the enlarged vein, and the fluid is so injected as to lie alongside of the vein, but not to enter it. The cure which follows in many of these cases has been ascribed to the inflammatory swelling which takes place, but there is, doubtless, besides this effect, a dynamical influence exerted on the vessel-walls.

It has lately been asserted that *deficient erections* and *loss of the capacity for coitus* are not unfrequently due to enlargement of the dorsal vein of the penis, and consequent too rapid emptying of the veins of the erectile tissue. Acting upon this plausible suggestion, the author has practised the hypodermatic injection of ergotine about the dorsal vein of the penis, and he has had apparently excellent results.

Before closing this article, it may be advisable to recall to the reader's attention the fact that the hypodermatic injection of ergot, or its internal administration in large doses, may cause such tonic contraction of the *sphincter vesicæ* as to render micturition impossible. Careful inquiry and frequent examinations of the hypogastric region should be made during a course of ergot preparations.

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Digitalis.—The leaves of digitalis purpurea, from plants of the second year's growth. *Feuilles de digitale*, Fr.; *Fingerhutblätter*, Ger.

Infusum Digitalis.—Infusion of digitalis (ʒ j — ℥ viij). Dose, ℥ ss — ℥ j.

Extractum Digitalis Fluidum.—Fluid extract of digitalis. Dose, m. v — ʒ ss.

Extractum Digitalis.—Extract of digitalis. Dose, gr. ss—grs. ij.

Tinctura Digitalis.—Tincture of digitalis. Dose, m. v — ʒ j.

COMPOSITION. — Digitalis contains an active principle, *digitaline.* This exists in the amorphous and crystalline form. The amorphous form—the digitaline of Homolle and Quévenne—possesses considerable activity, and, according to some authorities, is quite equal to the crystalline in strength. The crystalline digitaline (Nativelle's digitaline), physiological investigations have shown, is really an active principle which represents all of the powers of the drug. This occurs in needle-shaped crystals, and has an extremely bitter taste.

Digitalinum.—Digitaline. "A white, or yellowish-white powder, without odor, and having a very bitter taste. It is readily soluble in alcohol and in acids, but nearly insoluble in water and in ether." Dose, $\frac{1}{60}$—$\frac{1}{30}$ of a grain. It is frequently prescribed in the form of a granule containing one-sixtieth of a grain.

ANTAGONISTS AND INCOMPATIBLES.—The cinchona preparations, acetate of lead, the sulphate and tincture of the chloride of iron, are chemically incompatible Tannic acid and the preparations containing it diminish the physiological activity of digitalis. Opium, aconite, lobelia, and the cardiac paralyzers, antagonize some of the actions of digitalis, but the antagonism does not extend throughout the whole range of their influence. The most complete physiological antagonism exists between digitalis and saponine (Köhler), the active principle of *saponaria officinalis*, closely allied to *senegin.* If this fact be confirmed, senegin may be regarded as a physiological antagonist to digitalis.

SYNERGISTS.—Cold, ergot, belladonna, increase the physiological activity of digitalis.

PHYSIOLOGICAL ACTIONS.—Digitalis has a disagreeable, bitter taste. In considerable doses of the infusion, for example, it disturbs the stomach and gives rise to nausea and vomiting, and frequently purges. Loss of appetite results from its medicinal administration in some subjects, even when the quantity is small; but, in others, the appetite is increased. The active constituents of digitalis diffuse into the blood, but nothing is definitely known as to the action of this agent on the composition of the blood, or the influence which it has, if any, on the morphological elements.

On the heart digitalis exerts a peculiar action which requires attentive examination: it prolongs the *diastole* and increases the vigor of the *systole*. A lethal dose arrests the heart in systole, inducing a tetanic state of the heart-muscle. While digitalis increases the power of the systole, the diastole is prolonged, hence the number of pulsations per minute is reduced. With ordinary medicinal doses this slowing of the heart may be considerable, and the pulsations may descend to fifty or even forty per minute. Microscopic examination of the mesentery (Ackermann) and of the web of the frog has definitely ascertained that a marked contraction of the arterioles takes place under the influence of digitalis. The increased power of the systolic contraction of the heart and the greatly-increased resistance in front from a narrowing of the calibre of the vessels produce, as might *a priori* be expected, a considerable rise of the blood-pressure. When the pulse is greatly reduced by the administration of large medicinal doses, a change from the recumbent to the upright posture causes a remarkable increase in the number, and diminution in the force, of the cardiac pulsations. When lethal doses, short of a sudden toxic effect, have been experimentally administered, the slowing of the heart and rise of arterial tension first produced are succeeded by a quick, feeble pulse, and fall in the blood-pressure. These results are obviously due to the loss of power (paresis) which results from over-stimulation.

A temporary rise of temperature follows the administration of a lethal dose of digitalis, but this rise is soon succeeded by a marked and sustained reduction. Owing to the increased resistance from diminution of the calibre of the arterioles, the actual energy expended by the heart is in part converted into heat. Subsequently the slowing of the circulation, especially through the lungs (Traube), hinders the combustion process, and hence the fall of temperature.

Digitalis in full medicinal doses produces headache, a band-like feeling around the forehead, dizziness, disturbances of vision (mistiness, vibratory movements of external objects, chromatic dispersion, etc.), drowsiness, languor, and a sense of weariness, and it may even cause hallucinations, illusions, and delirium. Digitalis lessens the reflex function of the cord, lowers the sensibility of the nerves, motor and sensory, and impairs the electro-contractility of muscles; but these effects are not produced by medicinal doses, but are toxic in character.

As might be anticipated from a study of its physiological actions, digitalis acts like ergot on the enlarged uterus; it stimulates to energetic contraction the muscular fibres, and in this way arrests uterine hæmorrhage. On the genital organs of man it has a similar action; by diminishing the blood-supply to the erectile tissue it lessens the power of erections, and, secondarily, affects the venereal appetite, producing anaphrodisia.

Considerable difference of opinion exists as to the influence of digitalis on the function of nutrition—the metamorphosis of tissue. By some an increase in the production of urea, by others, a diminution has been noted. The truth, most probably, is that it has no real influence in urea formation, and that the variations observed are accidental. The phosphoric acid and chlorides are diminished. In health digitalis affects but little the water of the urinary secretion; according to some the water is diminished, according to others increased. It is difficult to reconcile these opposing statements, in view of the fact which has recently been ascertained by Brunton, that the diuretic action of digitalis in dropsy is not due to the increased blood-pressure, but to a special action on the Malpighian tufts.

THERAPY.—Before entering on the therapeutical applications of digitalis, there are several practical points with regard to the quality of the drug which require attention. Disappointment in the use of digitalis is frequently experienced, in consequence of the inferior quality of the drug prescribed. The wild digitalis is better than the cultivated. In this country much of the digitalis found in the shops is the plant cultivated and put up by the Shakers. It is very uncertain, and, according to the author's observation, usually inert. The English digitalis, and the preparations made from it, should alone be prescribed.

Digitalis has an undoubted power to arrest *hæmorrhage.* The mechanism of its action is similar to that of ergot; it slows the action of the heart and contracts the arterioles. In *hæmoptysis* it is especially useful in the following state of things: frequent expecterations of bloody mucus, with occasionally a mouthful of florid blood, accompanied by fever. This group of symptoms is dependent on transudation from a number of small vessels about the site of a pneumonia due to a tubercular or caseous deposition. The same kind of expectoration, due to *pulmonary congestion from mitral regurgitation*, is amenable to the same treatment. In *uterine hæmorrhage* digitalis is also serviceable, but it is more especially indicated in *menorrhagia* and *metrorrhagia* of plethoric subjects. Like ergot, digitalis has the power to induce uterine contractions, and hence it has been used successfully to arrest *post-partum hæmorrhage.* Cases of *menorrhagia*, of a peculiarly obstinate kind, are caused by mitral regurgitation or stenosis, the mechanical result being to increase the blood-pressure in the venous system of the uterus. Digitalis is the appropriate remedy in such cases. Granules of digitaline may be prescribed for some days previously to the occurrence of the menstrual molimen, but during the attack the infusion of digitalis is more serviceable. In cases of hæmorrhage, generally speaking, the infusion is the most effective form in which to employ digitalis. If the symptoms are urgent, a tablespoonful of the infusion may be given every half-hour until four doses are taken. In ordinary cases a tablespoonful of the infusion twice a day is a sufficient quantity to maintain a constant physiological effect. In the treatment of hæmorrhage, digitalis may be combined with other remedies which are synergistic. ℞. Infus. digitalis, ℥ ij; tinct. krameriæ, ext. ergotæ fluidi, āā ℥ j. M. Sig. *A tablespoonful pro re nata.*

In *purpura* and *the hæmorrhagic diathesis*, digitalis is useful when given conjointly with restorative medicines; but, as a dyscrasia exists on which the extravasations of blood depend, it is obviously necessary to correct this state of things, in order that the patient shall be benefited by a remedy which gives tone to the heart and vascular system.

The most important uses of digitalis are in *cardiac diseases.* In general terms it may be said that *it is indicated when the action of the heart is rapid and weak and the arterial tension low, and is contraindicated when the action of the heart is vigorous and the arterial tension high.*

In *simple hypertrophy*, which is compensatory, digitalis has no utility. In *stenosis of the aortic orifice, with compensatory hypertrophy*, it is not only useless, but it may give rise to serious symptoms, and even cause a fatal result, if administered in doses sufficient to produce physiological effects. When stenosis of the aortic orifice leads to incompetence and regurgitation of the mitral, then digitalis may be used with advantage. As respects the nature of the cardiac lesion merely, digitalis is useful in dilated heart with incompetence of the mitral, in disease of the mitral orifice with stenosis or regurgitation, and in dilatation of the right heart with incompetence of the tricuspid. As respects the mechanical difficulties which ensue from cardiac lesions merely, digitalis is useful, by reason of the increased power which it gives the auricles and ventricles to empty their respective cavities, and the longer intervals between the pulsations, which enable the auricles more perfectly to discharge their contents into the ventricles. The mechanical difficulty consists in a deficiency of blood (*ischæmia*) on the arterial side, and a stasis of blood on the venous side, of the systemic and pulmonary circulation. Digitalis, therefore, assists in the "compensation," or, in other words, by its action on the heart restores the mechanical balance of the circulation, deranged by the cardiac lesions. As respects the rational symptoms of heart-disease, digitalis is useful when the action of the heart is rapid and weak, the tension of the pulse low, when there are cough, difficulty of breathing, a dusky countenance, pulsating jugulars, scanty and high-colored urine, and general dropsy. As a rule, it may be stated that the rational signs furnish more conclusive indications of the need of digitalis than the physical. If given in suitable cases, the action of digitalis in heart-diseases is most conspicuous for good; but careful consideration should be given to the conditions detailed above if the practitioner would procure thoroughly satisfactory results. The form in which digitalis is prescribed is most important. The infusion is the best form in cases of cardiac disease with dropsy. It should be given in tablespoonful doses, twice a day, until some characteristic physiological effects are produced. After the subsidence of the severe symptoms digitaline-granules may be substituted for the infusion, or the powder of the leaves may be given in pill-form. As very decided anæmia is present in these cases, the best results are obtained by a combination of digitalis with quinia and iron. ℞. Pulv. digitalis, ℈ij; ferri redacti, quiniæ sulph., āā ℈j. M. ft. pil. no. xx. Sig. *One pill two or three times a day.*

The *antipyretic effect* of digitalis is a fact much insisted on in Germany (Traube, Wunderlich, Thomas, Liebermeister, etc.). In the recent elaborate work of Husemann digitalis is classed with the *Fiebermittel*—the "antipyretica." The results which have followed its administration as an antipyretic in fevers (typhoid, typhus, etc.), do not, it appears to the author, justify its use in these maladies, notwithstanding its power to lower the temperature. The indications for its use are, according to Liebermeister, just the opposite of those which obtain in cardiac disease; that is, "digitalis is only to be used in those cases of typhoid fever in which there is no considerable degree of cardiac weakness." He usually gives from eleven to twenty-two grains, extended over a period of about thirty-six hours.

In *scarlet fever* the utility of digitalis is very great; it lowers the temperature and maintains the action of the kidneys, thus obviating the two principal sources of danger in that disease. A drop or two of the tincture given every hour or two, according to the age, in a little water, or from half a teaspoonful to a teaspoonful of the infusion every two, three, or four hours, is a suitable mode of administration. If uræmia occur, the infusion is the proper remedy, conjoined, of course, with other means. The author has seen most excellent results from a poultice of digitalis-leaves, applied to the abdomen and back, in cases of *uræmic convulsions*, the patient being unable to swallow, or the stomach so irritable as to reject all medicines.

Digitalis has been used with success in *erysipelas*, but it is by no means equal to belladonna in this affection.

In *rheumatic fever* the testimony in favor of the use of digitalis is certainly very strong. It lowers the temperature, and apparently materially shortens the duration of the disease. It may be given in powders—two grains every four hours—or a corresponding quantity of the infusion. In rheumatism, as in every other affection, very prompt effects do not follow the use of digitalis; a day or two must elapse before any marked reduction of temperature takes place, but a cessation of the joint-trouble may be looked for in seven to ten days. Digitalis is more particularly useful in the *cardiac complications of acute rheumatism*, when irregular and feeble action of the heart, difficult breathing, cyanosis, and general œdema, are present. The following is a prescription of Oppolzer in this condition: ℞. Inf. digitalis, ℥ ij; liq. potassii citrat., ℥ jss; acet. scillæ, ℥ ss. M. Sig. *A tablespoonful every four hours.*

Digitalis has recently been much employed in *inflammatory affections*, notably *pneumonia.* On examination of the reported cases the author finds that the defervescence, produced apparently by digitalis from the sixth to the tenth day, occurred at the time when the *crisis* in pneumonia is to be expected, and hence it is difficult, if not impossible, to estimate the precise share which the remedy had in the results. That digitalis has any power to prevent the deposition of fibrinous material, to prevent or check the migration of the white corpuscles, or to arrest the multiplication of the cellular elements of inflamed parts, seems to the author highly improbable. That it may be useful to combat some of the symptoms—high temperature, ischæmia of the arterial system from pulmonary obstruction, and low tension of the vessels—may be well admitted.

There is considerable evidence to show that digitalis is serviceable in *chronic bronchitis with interstitial pneumonia* (fibroid lung), when accompanied with difficult breathing, secondary dilatation of the right cavities, and *general anasarca.* It diminishes the cough and expectoration, tones up the weakened and laboring heart, and reduces the œdema. That digitalis has any curative power in *pulmonary tuberculosis* or *caseous pneumonia*, can hardly be credited, notwithstanding the claims which have been put forward. It may be used as an *antipyretic* when there is much hectic, but the derangement of the intestinal canal produced by it is a most serious bar to its employment in phthisis.

Some important results have been obtained by the use of digitalis in *nervous diseases.* The *congestive form of hemicrania* may not unfrequently be permanently relieved by the persistent use of digitaline-granules (one-sixtieth of a grain *bis die*). *Acute maniacal delirium, chronic mania*, and *delirium tremens*, are disorders of the brain in which digitalis has proved very useful. The conclusions of Dr. Williams, of Hayward's Heath Asylum, are as follows:

"1. That digitalis is a valuable sedative in the treatment alike of recent and chronic mania, and when these forms of disease are complicated with general paresis and with epilepsy.

"2. That the average dose of the tincture is from ʒ ss to ʒ j, and this quantity may be certainly given with impunity for several days, and subsequently—adjusted to the state of the pulse—may be advantageously used for several months.

"3. That the indication by which the use of this drug is regulated is the state of the pulse, any marked intermittence requiring its immediate discontinuance.

"4. That the weakness of the circulation is no indication against its employment; on the contrary, experience shows that the most enfeebled subjects bear its administration as well as the most robust."

In *delirium tremens* extraordinary doses of the tincture of digitalis have been used with success (ʒ ij—ʒ iv), but these large doses are unnecessary. This treatment is most useful in the young and robust, with marked cerebral hyperæmia, according to some; but, according to others, in pale subjects with a tendency to cyanosis, the state of the brain being one of anæmia, with effusion and œdema. According to the author's observation, the latter indications are the more correct. The infusion is doubtless a better preparation than the tincture, and of this a tablespoonful may be administered every four hours.

Some supposed cases of *arachnitis* have been reported cured by digitalis, but grave doubts must exist as to the accuracy of the diagnosis.

Cases of *exophthalmic goitre* in young subjects, purely functional in character, have been cured by *digitalis*, and the cardiac irregularities, and the dilatation of the cervical vessels, ameliorated in even incurable cases. Digitaline is the form in which to employ this remedy, or powdered digitalis may be given in pill, with iron and manganese to remove the anæmia.

Since the anaphrodisiac properties of digitalis were ascertained, it has been much used in *spermatorrhœa*. It is adapted to the same class of cases as those in which ergot has been shown to be so beneficial, viz., feeble erections, frequent emissions, and cold hands and feet. The author has seen better results from the combination of bromide of potassium and digitalis, in the spermatorrhœa of plethora, than from any other remedies: ℞. Inf. digitalis, ℥ viij; potassii bromidi, ℥ j. M. Sig. *A tablespoonful morning and night, and, after a week, at night only.*

Digitalis is one of the most generally useful remedies in dropsy which we possess. It is, of course, specially useful in the mechanical dropsy of valvular lesions. In *renal dropsy* from *acute desquamative nephritis* (tubal nephritis) "of all drugs, digitalis is of the greatest value," and the best form in which to administer it is the infusion. Several days usually elapse before very decisive results are achieved, but the flow of urine is, then, often enormous. The fact that, contrary to what has been heretofore believed, digitalis has a direct action on the glomerule of the kidney, is of great interest in this connection. The author has seen very favorable results from the use of digitalis in *granular degeneration of the kidney* when dropsy supervened, but its use in this disease requires caution in consequence of the fact that the elimination of urea and of the chlorides is retarded by this agent.

The so-called Cumulative Effects of Digitalis.—The author agrees in opinion with those who hold that digitalis is not a cumulative poison in the sense in which this term was formerly used. Doses of digitalis frequently repeated, so that the effect of one is added to those before given, will certainly produce toxic symptoms. In this sense opium, belladonna, strychnia, etc., are cumulative poisons. If full doses of digitalis are given at proper intervals, and the effects of one dose are permitted to cease before the next is given, no accumulation will take place. Sudden toxic symptoms are developed as follows: When, after the administration of large doses, the pulse is much reduced in the recumbent posture, on rising, the heart is suddenly found unequal to maintaining the circulation in face of the increased resistance in the arterioles and against the force of gravity. It must not be forgotten, further, that the irritability of the vaso-motor nervous system may be destroyed by overstimulation by digitalis, and lethal effects be produced in this way.

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Cimicifuga.—Black snake-root. The root of cimicifuga racemosa.

Extractum Cimicifugæ Fluidum.—Fluid extract of cimicifuga. Dose, ʒ ss—ʒ ij.

Tinctura Cimicifugæ.—Tincture of cimicifuga (unofficinal). Dose, ʒ ss—ʒ ij.

Composition.—When fresh, the root contains a volatile oil, which possesses in a high degree the characteristic odor of the drug. A true active principle has not yet been isolated, yet Conara has obtained a neutral substance, crystallizable, and having a very acrid taste. The so-called *cimicifugine* is nothing more than an impure resin, obtained by precipitation from the tincture by the addition of water. The root contains resin, coloring matters, tannic and gallic acids.

Antagonists and Incompatibles.—As the preparations of cimicifuga contain tannic and gallic acids, they are incompatible with the salts of iron. Stimulants, as alcohol, ammonia, antagonize cimicifuga therapeutically.

Synergists.—In its action, although feeble, cimicifuga lies between digitalis and ergot. Its physiological effects are increased by cold, digitalis, ergot, belladonna, etc.

Physiological Actions.—The taste of cimicifuga is bitter and astringent, with an after acrid feeling. In small doses, without producing any sensible physiological effect, it promotes the appetite and digestion. In full doses it increases the gastro-intestinal secretions. On the heart and circulatory system, cimicifuga has an action not unlike digitalis, but less powerful: it slows the heart-beats but increases their force, and elevates the tension of the arterial system. Its effects on the nervous system, when administered in large doses, are very decided. It causes vertigo, dilated pupils, and in many subjects considerable soporific and anodyne effects. There is little doubt that it increases the contractility of unstriped muscular fibre in a manner that resembles ergot, but much less energetically. It stimulates the venereal appetite in man, and promotes the menstrual flow in women. Diaphoresis and increased bronchial secretion are produced by it, and the urine possesses a distinct odor of the drug.

In order to procure physiological effects from cimicifuga, it is essential that preparations made from the fresh root be employed.

Therapy.—Cimicifuga is an excellent *stomachic tonic*, and is especially adapted to the treatment of the *irritative dyspepsia of drunkards.* In *fevers* and *inflammatory disorders*, when the action of the heart is quick and the tension of the vessels low, cimicifuga may take the place of digitalis, but it is much less efficient than the latter. It is an *excellent expectorant*, useful in bronchitis and in neuropathic pulmonary disorders. ℞. Ext. cimicifugæ fl., ℥ss; tinct. opii deod., ʒij; syrp. tolu., ʒx. M. Sig. *A teaspoonful every four hours.* This combination is efficacious in *acute catarrh* (common cold), and in *acute bronchitis* after the more active symptoms have subsided. Good results have been obtained from cimicifuga in *phthisis.* It would be idle to claim that it is curative; but, to moderate hectic, to improve the appetite, and to facilitate expectoration, it is undeniably of service. It is in that form of phthisis now called *caseous pneumonia* that cimicifuga can be expected to relieve symptoms, and not in tuberculosis.

Dilated heart, fatty heart, languid circulation, oppressed breathing, general dropsy, are conditions in which cimicifuga takes the *rôle* of digitalis, and sometimes more efficiently. It is safer than digitalis, especially in the case of fatty heart.

Most favorable reports have been made of cimicifuga in *acute rheumatism. Chronic rheumatism, with tumefaction of the joints, lumbago, intercostal pain*, and *myalgia*, are disorders affecting the muscular system, in which this drug sometimes succeeds in a wonderful manner; yet it very often fails, and we are, unfortunately, unable to indicate beforehand the particular kind of cases in which it is most beneficial.

The power of cimicifuga to relieve certain kinds of pain is well established. *Neuralgia of the fifth*, arising from cold, *rheumatic headache, ovarian neuralgia*, succeeding to suppressed or arrested menstruation, etc., are forms of pain in which this remedy is frequently very effective.

Puerperal mania, hypochondriasis, and convulsions, due to menstrual irregularities, have been cured by cimicifuga. The greatest successes of this drug have been achieved in *chorea.* It is useful in those cases which arise about the period of puberty, and are connected with disorders or perversions of the menstrual flow.

Cimicifuga relieves the pains of *dysmenorrhœa* when of the congestive variety. *Heat of head, flushings of the face, pain in the head, back, and limbs, quick pulse, and nervousness*, when due to arrest of the monthly flow, are often remarkably benefited by this agent. It has been used to promote *parturient pains*, to induce *uterine contractions* after delivery, and to relieve after-pains, but it is inferior to ergot for most of these purposes. It is serviceable in *subinvolution of the uterus*, and may be given in combination with ergot.

The aphrodisiac effects of cimicifuga render it useful in *spermatorrhœa.* It is not adapted to physiological spermatorrhœa, which is really a condition of normal plethora, but to those cases in which the organs are relaxed, the erections weak, and the seminal discharges feeble and occur on slight excitement.

To obtain curative effects from cimicifuga, it must be administered in sufficiently large doses to produce some of its cerebral effects.

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Belladonna.—Deadly nightshade.

Belladonnæ Folia.—Belladonna-leaves. *Feuilles de belladone*, Fr.; *Tollkraut*, Ger.

Belladonnæ Radix.—Belladonna-root. *Racine de belladone*, Fr.; *Belladonnawurzel*, Ger.

Emplastrum Belladonnæ.—Belladonna-plaster. (Belladonna-root and resin-plaster.)

Extractum Belladonnæ.—Extract of belladonna. Dose, gr. ¼—gr. j.

Extractum Belladonnæ Alcoholicum.—Alcoholic extract of belladonna. Dose, gr. ¼—gr. j.

Extractum Belladonnæ Fluidum.—Fluid extract of belladonna. Dose, m. j—m. v.

Suppositoria Belladonnæ. Suppositories of belladonna. (Alcoholic extract and cacao-butter. Each suppository contains thirty grains—gr. ss—grs. xxixss.)

Tinctura Belladonnæ.—Tincture of belladonna. Dose, m. v—ʒ ss.

Unguentum Belladonnæ.—Ointment of belladonna. (Extract, ʒ j; lard, ʒ vij.)

Composition.—Belladonna contains a peculiar alkaloid atropia, on the presence of which the physiological activity of the drug depends. This principle is found chiefly in the bark of the root, and of young root. Another principle has also been discovered analogous to atropia, to which the name *belladonnine* has been given. The root also contains a fluorescent substance and a coloring matter, which has been called *atrosin.* Atropia exists in the plant in combination with malic acid as *bimalate.*

Atropia.—Atropia. "Is in yellowish-white, silky, prismatic crystals, without smell, but having a bitter and acrid taste. It is soluble in three hundred parts of water at 60° Fahr., in twenty-five parts of ether, and in much less alcohol. It has a strong alkaline reaction, and forms crystallizable salts with acids."

Atropiæ Sulphas.—Sulphate of atropia. "Is a white, slightly crystalline powder, very soluble in water and in alcohol, insoluble in ether, and wholly dissipated by heat." Dose, gr. $\frac{1}{120}$—gr. $\frac{1}{60}$.

Antagonists and Incompatibles.—Caustic alkalies act on atropia, and ammonia is evolved; they are, therefore, incompatible with the preparations of belladonna. As respects physiological antagonism, physostigma counterbalances the actions of belladonna in almost the whole range of its influence. Opium—within certain limitations to be hereinafter described—antagonizes the actions of belladonna. In cases of poisoning, the stomach should be promptly emptied by emetics (sulphates of zinc or copper), and the nervous disturbances combated, as they arise, by physostigma or opium.

Physiological Actions.—Dryness of the mucous membrane of the nose, mouth, throat, and larynx, is produced by the direct application of atropia to these parts, and the same effects in a more positive manner follow the stomach or subcutaneous administration. A peculiar bluish appearance of the lips, as well as dryness, the author has frequently observed. Nausea is occasionally produced by belladonna, but this effect is probably due to cerebral disturbance. Dryness of the mucous membrane of the stomach and intestines is doubtless produced by belladonna, but increased secretion occurs subsequently, for the stools are rendered more liquid, and are also voided more frequently. Increased peristalsis is most probably a result of the action of belladonna on the unstriped muscular fibre of the intestines.

The active principle of belladonna (atropia) is an extremely diffusible substance. What changes it induces in the blood, if any, are not known. It affects the circulation in a remarkable manner. In some subjects a decided slowing of the heart takes place immediately after the administration of a considerable dose (atropia hypodermically), and in all, most probably, an instantaneous retardation of the pulse-rate, but a very decided rise in the number of pulsations quickly follows. Not only is the number of the heart-beats increased, but their vigor also, and the area over which the pulsations are distributed is enlarged. It has been conclusively shown that the increased action of the heart is due, first, to stimulation of the cardiac ganglia of the sympathetic, and, secondly, to a paralyzing action on the pneumogastric terminal filaments. In other words, the motor power of the heart is increased in activity, and the inhibiting control is lessened.

The stimulation of the vaso-motor centres by belladonna, or atropia, is not confined to the cardiac ganglia, but extends to the vaso-motor ganglia throughout the body, and a general rise of blood-pressure takes place owing to a contraction of the arterioles. It is a singular fact that the influence of atropia rapidly produces a state of over-excitation, and the irritability of the vaso-motor nervous system, at first increased, soon diminishes; the action of the heart becomes weak, the vessels dilate, and the blood-pressure falls below the normal. In large medicinal doses this effect is easily seen, and, in lethal doses in animals, it may be most certainly demonstrated.

As regards the function of respiration, atropia increases the number and depth of the respiratory movements, but the increase is not in the same ratio as is the elevation of the pulse-beat. The more rapid action of the heart, the increased respiratory movements, the contraction of the arterioles, result in an increased supply of blood to the periphery, more rapid nutritive changes, and consequent elevation of temperature. The rise in temperature in man, from a full medicinal dose, is from ½° to 1° Fahr. This increased body-heat is not long maintained; with the fall in the blood-pressure (vaso-motor paresis), there ensues a diminution in temperature.

and, in some cases, by the local application of the belladonna preparations.

No remedy is so generally effective in relieving the *sweats of phthisis* as atropia. The one-sixtieth of a grain at bedtime usually suffices. The author was the first to indicate this use of atropia in his "Prize Essay." Not only is atropia antagonistic in action to that condition of the sudoriparous glands resulting in the sweats of disease, but it equally antagonizes the hyperidrosis produced by such drugs as jaborandi.

In connection with the subject of the use of atropia in the night-sweats of phthisis, it may be proper for the author to state that he has observed cases of phthisis which appear to him to have been remarkably improved by the continued use of this remedy.

HYPODERMATIC USE OF ATROPIA.—The solution usually employed for this purpose is two grains of the sulphate of atropia to an ounce of distilled water, the dose of which ranges from two to five minims.

There are two forms of *neuralgia* in which the subcutaneous use of atropia has been most signally useful: *tic-douloureux* and *sciatica*, more especially the latter. Atropia is not as effective in the treatment of the neuralgias in general as morphia, and the systemic effects of the former are much more unpleasant than those caused by the latter. Nevertheless, when morphia fails or disagrees with the patient, atropia may be used with confident expectation of its affording relief. We owe to Hunter our knowledge of the fact that atropia has a very special utility in *tic-douloureux* and *sciatica*. The merely subcutaneous injection of atropia does not afford the same degree of relief as its deep injection in the neighborhood of the affected nerve-trunk. Furthermore, a decided impression must be made on the cerebrum, in order to obtain the best results. The largest doses compatible with the safety of the patient must be used—generally the one-fiftieth of a grain to the one-thirtieth. If the remedy is employed in sufficient quantity, and well inserted into the tissues about the nerve, decided curative results may be expected from it in these two forms of neuralgia. When relief follows the injection of atropia, it is apt to be more permanent than when the same degree of relief is obtained from morphia. We have the high authority of Dr. Anstie for the assertion that atropia is exceptionally serviceable in *peri-uterine* and *dysmenorrhœal neuralgia*. The eminent Dr. Weir Mitchell asserts that atropia in *traumatic neuralgias* is "simply useless," and, as his power of accurate observation is unquestioned, and his clinical opportunities vast, we may accept this conclusion as final.

Muscular cramp, from injuries to the nerve-trunk, are often remarkably relieved by injections of atropia into the substance of the affected muscles. The so-called "late rigidity," as a result of which the members may be put into very injurious positions, is occasionally removed or diminished by the same expedient, viz., injecting a small quantity of atropia ($\frac{1}{120}$ of a grain) into the contracted muscles. This result does not ameliorate the condition of the patient to any greater extent than that of affording relief to an inconvenient deformity.

The *insomnia of mental disorders*, and of *delirium tremens*, may be overcome by the hypodermatic injection of atropia when the following indications for its use are present: Coma vigil, great restlessness, weak action of the heart, coldness of the surface, cyanosis, clammy sweat. When there is a condition of hyperæmia of the cerebro-spinal centres, excitement with elevated pulse-rate and increase of arterial tension, atropia can only do harm.

The treatment of *asthma* by belladonna, administered by the stomach and in the form of fumigation, has already been referred to. The hypodermatic injection of atropia is much more effective. From $\frac{1}{120}$ to $\frac{1}{60}$ of a grain may be used for this purpose; but, as the relief comes from the systemic effect, it is not necessary to inject the solution in the neighborhood of the pneumogastric, as practised by Courty. In order to procure the greatest relief, the injection should be made at the beginning of the asthmatic paroxysm, and succeeding attacks should be anticipated by inducing atropinism at the first warning of a seizure.

Vomiting of pregnancy, when obstinate and resisting other means, is sometimes arrested promptly and permanently by the subcutaneous injection of atropia in small quantity ($\frac{1}{120}$ of a grain). *Sea-sickness* is relieved in the same way. In these maladies, it is better to insert the injection in the epigastrium.

Cramp of the hollow muscular organs—*hepatic*, *intestinal*, *uterine*, *and renal colic*—may all be relieved by the subcutaneous injection of atropia, but the most satisfactory results are produced by the combined use of atropia and morphia.

EXTERNAL APPLICATION OF BELLADONNA PREPARATIONS.—The chloroformic solution of atropia is an excellent external application *to relieve pain* in nerves superficially situated. ℞. Chloroformi, spts. vini rect., āā ℥ ss; atropia, grs. v. M. Sig. *Apply on lint to painful part, and cover with oiled-silk.* The same application to the epigastrium sometimes arrests *obstinate vomiting*, cerebral or reflex, as for example the *vomiting of pregnancy*, *sea-sickness*, etc. A belladonna-plaster is an excellent application to relieve the *chest-pains of phthisis*, *to allay irritability of an over-excited heart*, to diminish the pains and soreness of *lumbago*, *myalgia*, etc.

Excessive sweating of a part, as for example, *unilateral sweating of the head*, may be removed by brushing over the affected surface a solution of atropia (grs. iv — ℥ j).

There is no doubt that belladonna has the power to arrest the secretion of milk, in the same way that it stops the cutaneous transpiration, for the milk-gland is only an enlarged sebaceous gland whose function is differentiated from that of other sebaceous glands of the body. When it is desirable *to arrest the secretion of milk*, the gland may be enveloped by a belladonna-plaster, or the ointment of belladonna may be carefully rubbed into the integument. These are rather disagreeable, sticky applications, which soil the clothing. A much more elegant method of applying this treatment is to envelop the breast in lint wetted with a solution of atropia, four grains to the ounce of rose-water. As systemic effects may be produced by such an application, when the pupils dilate and the mouth becomes dry, it should be removed. *Inflamed breasts* may be treated in the same way. The mode of action of the belladonna preparations is quite obvious: the irritability of the terminal filaments of the nerves is allayed by the direct action of the atropia, and the arterioles are made to contract, thus diminishing the blood-supply to the inflamed tissue.

Other superficial inflammations are subdued by the same treatment, as, for example, *abscesses, boils, carbuncles.* A plaster made of belladonna extract may be kept in contact with the inflamed tissue, or the solution of atropia, above recommended, may be used.

Pruritus of the vulva, vaginismus, fissure of the anus, are sometimes relieved, as if by magic, by the use of the atropia solution above recommended.

Whenever atropia is used locally for the relief of inflammatory pain and swelling, the efficiency of the application is much increased by the addition of morphia, or morphia and chloral, according to formulæ to be given hereafter in the article on the latter drug.

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Stramonium.—Leaves and seed of datura stramonium. *Stramoine*, Fr.; *Stechapfel*, Ger.

Stramonii Folia.—Stramonium-leaves.

Stramonii Semen.—Stramonium-seed.

Extractum Stramonii Foliorum.—Extract of stramonium-leaves. Dose, gr. ⅛—gr. j.

Extractum Stramonii Seminis.—Extract of stramonium-seed. Dose, gr. ⅛—gr. ss.

Tinctura Stramonii.—Tincture of stramonium. Dose, m. v—ʒ ss.

Unguentum Stramonii.—Ointment of stramonium.

COMPOSITION.—Stramonium contains an alkaloid, *daturia*, which is chemically and physiologically identical with *atropia*. It is contained in the seeds in the proportion of about one-tenth per cent., and in the leaves in much smaller quantity. It exists in the plant in combination with malic acid. The seeds contain a fixed oil in considerable quantity.

ANTAGONISTS, INCOMPATIBLES, AND SYNERGISTS, are the same as for belladonna.

Hyoscyamus.—Leaves and seed of hyoscyamus niger. Fr.; *Bilsenkraut*, Ger.

Hyosciami Folia.—Hyoscyamus-leaves.

Hyosciami Semen.—Hyoscyamus-seed.

Extractum Hyoscyami Alcoholicum.—Alcoholic extract of hyoscyamus. Dose, gr. ⅛—gr. j.

Extractum Hyoscyami.—Extract of hyoscyamus.

Extractum Hyoscyami Fluidum.—Fluid extract of hyoscyamus. Dose, m. v—ʒ ss.

Tinctura Hyoscyami.—Tincture of hyoscyamus. Dose, ʒ ss—℥ ss.

COMPOSITION.—Hyoscyamus contains an active principle (*hyoscyamia*), a fatty oil, and the leaves are rich in nitrate of potassium. The seeds possess a larger quantity of hyoscyamia than the leaves.

ANTAGONISTS, INCOMPATIBLES, AND SYNERGISTS, are the same as for belladonna.

PHYSIOLOGICAL ACTIONS.—As atropia, daturia, and hyoscyamia, are similar if not identical in chemical composition and in physiological action, the remarks already made in regard to the actions and use of belladonna are applicable to stramonium and hyoscyamus.

The following conclusions, to which MM. Oulmont and Laurent have been conducted, appear to the author to be thoroughly well grounded:

1. Hyoscyamia and daturia act especially on the sympathetic nervous system.

2. In small doses they reduce the capillary circulation [contraction of the arterioles]; in large doses they produce paralysis of the vessels [exhaust the irritability of the vaso-motor system].

3. The arterial tension is increased by the administration of weak, and is diminished by powerful, doses. These effects are not modified by section of the vagi.

4. The frequency of the pulse is increased, and its fullness diminished.

5. Hyoscyamia renders the movements of the heart regular; daturia often produces intermittence and arrest of action. When applied directly both alkaloids slow, and ultimately arrest, the beats.

6. Both always accelerate the respiration.

7. Neither has any direct action on the nervous system of animal life. Sensation and motor power are not modified by them. In toxic doses they blunt cutaneous sensibility.

8. These alkaloids have no action on the excitability of striated muscles; they do not modify their structure.

9. In small doses they accelerate the movements of the intestines; in large doses they paralyze them.

10. The general phenomena observed when these alkaloids are given are due to modification of the circulation, and disappear rapidly. The alkaloids are soon eliminated, especially by the urine, in which they may be found.

11. The dilatation of the pupil which is produced is due to stimulation of the sympathetic; the third pair of nerves is not concerned in its production.

12. Small doses generally give rise to slight increase of temperature; large doses diminish the central temperature.

THERAPY.—Stramonium and hyoscyamus may be used like belladonna for the relief of painful affections, the *neuralgiæ;* but they possess no special advantages over their more powerful congener. Oulmont has used the hypodermatic injection of hyoscyamia with remarkable success in several cases of neuralgia, but he does not regard it as more conspicuous and rapid than is obtained from opium and belladonna. Stramonium is used with advantage in the treatment of *dysmenorrhœa.* ℞. Ext. stramonii, ext. hyoscyami, ext. opii, āā gr. vj. M. ft. pil. no. xij. Sig. *One pill every three, four, or six hours.* This combination gives great relief in dysmenorrhœa, and may also be serviceable in neuralgia.

In affections characterized by *spasm*, as *asthma*, *laryngeal cough*, *hepatic*, *intestinal*, *renal*, and *uterine colic*, stramonium and hyoscyamus may be given with advantage, in place of or in combination with belladonna. The hypodermatic injection of hyoscyamia or daturia is an excellent expedient for procuring relief in these cases, but these alkaloids are not more effective than atropia. Hyoscyamus, especially in the form of tincture, is frequently prescribed in *irritable states of the bladder* due to the presence of stone, enlargement of the prostate, and in catarrh of the bladder arising by transference of irritation from the urethra. It should not be forgotten that liquor potassæ, so much prescribed in a mixture with hyoscyamus, is incompatible.

M. Oulmont refers, in terms which may seem to be exaggerated, to the great efficiency of hyoscyamia in the treatment of *mercurial tremor*, *senile tremor*, *paralysis agitans*, *locomotor ataxia*, and *tetanus*. In *mercurial* and *senile tremor* cures were obtained, but, as might be expected, only amelioration in *paralysis agitans*, *locomotor ataxia*, and *tetanus* The dose which Oulmont found effective was the one-thirty-second of a grain of hyoscyamia, gradually increased to the one-fifteenth of a grain.

The *hypnotic quality* is much more conspicuous in hyoscyamus than in belladonna or stramonium. In children it has long been known that, when opium is not well borne, hyoscyamus is an efficient substitute. Recent experience in asylum practice has shown that hyoscyamus in large doses is a very valuable hypnotic. According to Dr. Campbell, two and a half drachms of the tincture are equivalent in hypnotic power to thirty grains of chloral hydrate. In order to procure efficient hypnotic effects, from two drachms to an ounce of the tincture is necessary, and this large quantity appears to be free from danger.

Extract of hyoscyamus is used in *combination with purgatives*, with the object—which abundant clinical observation confirms—of rendering their operation more efficient, and, at the same time, less drastic.

The ointment of stramonium is a favorite application to *irritable ulcers*, *superficial inflammations*, etc.

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B.—AGENTS EXCITING THE FUNCTIONAL ACTIVITY OF THE CEREBRUM.

To this group belong those remedies usually classed together under the designation of *antispasmodics.* They are to a slight degree cardiac stimulants; they increase the cutaneous circulation, and promote diaphoresis ; they also stimulate the bronchial mucous membrane, and favor expectoration. As a result in part of the increased rapidity of the circulation, the functions of the brain become slightly more active, ideas flow more freely, irregular mental excitement and muscular hyperkinesis are moderated, and an orderly feeling of well-being is established. These effects are probably in part due to a direct action of these agents on the gray matter of the hemispheres, but our knowledge does not at present permit an exact statement of the nature of this impression. These agents do not in any quantity suspend the functions of the brain, and the temporary increase of activity which they produce is not followed by manifest depression.

Camphora.—Camphor. *Camphre,* Fr.; *Campher,* Ger. "A peculiar, concrete substance, derived from camphora officinarum, and purified by sublimation."

Aqua Camphoræ.—Camphor-water. Dose, ʒ j — ℥ j.

Linimentum Camphoræ. — Camphor-liniment. (Camphor, ℥ iij; olive-oil, ℥ xij.)

Linimentum Saponis.—Soap-liniment. (Soap, camphor, oil of rosemary, alcohol, and water.)

Spiritus Camphoræ.—Spirit of camphor. (Camphor, ℥ iv; alcohol, Oij.) Dose, m. v—m. xx.

Camphora Monobromata.—Monobromide of camphor. Dose, grs. ij—grs. x (unofficinal).

COMPOSITION AND PROPERTIES.—Camphor is found in colorless, translucent, crystalline masses. One part dissolves in about 1,300 parts of water, but it is freely soluble in alcohol, ethers, oils, chloroform, bisulphide of carbon, etc. Its odor is peculiar and characteristic. The formula for camphor is the following: $C^{10}H^{16}O$. By distillation with chloride of zinc it is converted into *cymol,* and by oxidizing agents into *camphoric* and *camphretic* acids.

ANTAGONISTS AND INCOMPATIBLES.—The addition of water precipitates camphor from its spirituous solution. Alkaline and earthy salts, for example sulphate of magnesium, separate from its solution the small quantity of camphor contained in aqua camphoræ. Coffee, the arterial sedatives, cold, and depressing causes generally, antagonize its physiological action.

SYNERGISTS.—All the remedies of this group, and alcohol, opium, and narcotic substances, increase the effects of camphor.

Physiological Actions.—Applied to the skin, camphor produces redness, heat, and superficial inflammation, if the contact be sufficiently prolonged; to an open wound its effects are still more severe. Its taste is hot, aromatic, and pungent. In the stomach it causes a sensation of heat, and may excite in large doses inflammation and ulceration. The symptoms common to irritant poisons may, therefore, be produced by camphor. After experimental doses in animals camphor has been detected in the blood of the mesenteric and portal vein, but not in the chyle or urine. In moderate doses (medicinal) it increases the action of the heart, elevates the arterial tension, and promotes cutaneous transpiration; it also produces mental exhilaration, even a gay and lively intoxication, and allays pain. In toxic doses, in addition to the local irritant action on the gastro-intestinal mucous membrane, and the consequent systemic effects, it lowers the pulse, the skin becomes pale, and the surface cold and moist, stupefies, diminishes the reflex functions of the spinal cord, and causes convulsions, insensibility, and death; but these cerebral phenomena are not separable from the reflex effects, on the nervous centres, of the violent gastro-intestinal disturbance. Sometimes dysuria has been caused by camphor, and, in small doses, owing doubtless to the merely stimulant effects on the circulation, it increases the sexual appetite; but, in large doses, it is antaphrodisiac.

Camphor, after absorption, is eliminated chiefly by the skin and bronchial mucous membrane, hence the breath and sweat of those using this substance smell of it strongly; but, when much camphor is taken in the solid form, it escapes with the fæces.

Therapy.—Camphor enters into the composition of many *dentifrices.*

Camphor is contraindicated in all inflammatory affections of the gastro-intestinal mucous membrane. In *hysterical vomiting* a few drops of the spirit (two to five), every half-hour or hour, will often give relief. Camphor is an efficient remedy in *summer diarrhœa.* It is usually combined with opium: ℞. Spirit. camphoræ, tinct. opii, āā ℥ ss. M. Sig. *Ten to thirty drops every two, three, or four hours.* ℞. Aqua camphoræ, ℥ iij; tinct. lavendulæ comp., ℥ j; tinct. opii, ʒ j — ʒ ij. M. Sig. *A tablespoonful every hour or two.* This is an excellent formula, omitting the opium, for *flatulence*, especially *hysterical flatulence* and the *flatulent colic* which so often occurs during the climacteric period. For the *preliminary diarrhœa* of *Asiatic cholera* camphor is largely used, and with very obvious benefit. A drop or two of the saturated tincture (Rubini's), or five to ten drops of the spirit, may be given with a little laudanum every half-hour or hour. Oppolzer gave the ethereal tincture with opium: ℞. Camphoræ, ℥ j; etheris, ℥ vij; tinct. opii, ʒ j. M. Sig. *Twenty to forty drops, as necessary.* Camphor, which is very serviceable in the *summer diarrhœa of children*, may be given to these little subjects in milk, in which it is soluble in the proportion of one drachm to four ounces.

Spirits of camphor, in the form of vapor, is a useful inhalation in the incipiency of *acute catarrh.* Dr. Beard speaks in very enthusiastic terms of a camphor preparation which he has called "cold powder." This formula is as follows: "Camphor five parts. Dissolve in ether to the consistence of cream. Then add carbonate of ammonium four parts, opium-powder one part." The dose of this ranges from three to ten grains. Dr. Beard finds this combination of "great value in *breaking up colds*, when taken in time, and in modifying their force when taken late."

Camphor was formerly much used in the treatment of *asthma*, but, at present, more efficient remedies have taken its place. The monobromide of camphor has proved decidedly beneficial in *whooping-cough.* Five grains, suspended in mucilage and sirup of tolu, may be given to a child three or four times a day. It is most serviceable in the spasmodic stage, but will do good at any period.

Camphor will allay cough and promote expectoration, hence its utility in *chronic bronchitis*, in *capillary bronchitis* when stimulants are needed, and in *emphysema.* In the so-called *typhoid pneumonia* camphor is serviceable as a stimulant, in small and frequently-repeated doses, to sustain the powers of life during the period of defervescence.

In *typhus* and *typhoid fevers*, and in the *exanthemata* generally, camphor is used to accomplish two objects—to quiet delirium, subsultus, or restlessness, and to overcome the cardiac depression. When very active interference is unnecessary the following can be used: ℞. Aqua camphoræ, liq. ammoniæ acetatis, āā ℥ ij. M. Sig. *A tablespoonful every two hours.*

Attacks of *nervousness* and *hysteria* are relieved by camphor-julep, i. e., camphor rubbed up with mucilage. Some cases of *delirium tremens* are benefited by camphor, but it is impossible to indicate the special condition requiring it. *Maniacal excitement*, *melancholia*, and *erotomania*, have also been relieved by this agent, but a great uncertainty exists as to the indications for its employment. Large doses are necessary in these affections, and they should at first be tentative, for it is not possible in the present state of our knowledge to predict the results of any given trial. On the whole, but little dependence is to be placed on camphor; besides, more certain and effective remedies are now available for the treatment of these maladies.

There appears to be a satisfactory clinical experience as respects the use of camphor to *allay sexual excitement.* Large doses (from ten to twenty grains) diminish the venereal appetite, and the vigor of the erections; hence the use of camphor in *priapism*, *satyriasis*, *nymphomania*, *chordee*, etc. The following is a formula of Ricord: ℞. Camphoræ, lactucarii, āā ʒ j. M. ft. pil. no. xxx. Sig. *One or two pills, or more, as necessary.* For *nocturnal seminal losses*, with weakness and relaxation of the genitalia, the following formula is useful: ℞. Ergotine (aq. ex., Squibb's), ℈ij; camphoræ, ʒj. M. ft. pil. no. xxx. Sig. *Two at bed-hour.* A full dose of camphor will often arrest the *strangury* produced by blisters.

Considerable testimony has been collected showing the value of camphor as a remedy in *senile gangrene*, and in *hospital gangrene.* Five to fifteen grains every four hours may be given in an emulsion, and powdered camphor may be applied freely to the sloughing surface. A clyster of camphor is an effective remedy against *ascarides.*

Camphor was a favorite remedy with Dewees for *dysmenorrhœa.* He gave ten grains in a mixture with mucilage and cinnamon-water, and repeated the dose in an hour or two if necessary. For *after-pains*, camphor (ten grains), in a mixture with a little morphia (one-eighth of a grain), is an effective remedy.

EXTERNAL USES.—A cataplasm of camphor, morphia, and flaxseed, applied to the cheek will relieve *toothache.* *Camphorated oil* is a mild counter-irritant, which is a useful external application for the relief of internal inflammations. The solution of camphor in ether has been applied locally with benefit in *erysipelas.* *Myalgia, lumbago*, and *neuralgia of superficial nerves*, may sometimes be relieved by frictions with camphorated oil, or soap-liniment. Powdered camphor, freely sprinkled over the surface, is one of the means resorted to, and sometimes with success, to prevent *pitting of the face from variola.*

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Asafœtida.—Asafœtida. A gum-resinous exudation, obtained by incision, from the root of narthex asafœtida. *Asafœtida*, Fr.; *Teufelsdreck*, Ger.

Emplastrum Asafœtidæ.—Asafœtida-plaster.

Mistura Asafœtidæ.—Asafœtida-mixture. Dose, ℥ss — ℥ij.

Tinctura Asafœtidæ.—Tincture of asafœtida. Dose, ʒss — ʒij.

Pilulæ Asafœtidæ.—Pills of asafœtida. (Asafœtida and soap.) Dose, 1—4 pills.

Pilulæ Aloës et Asafœtidæ.—Pills of aloes and asafœtida. (Asafœtida, aloes, soap.) Dose, 1—4 pills.

Pilulæ Galbani Compositæ.—Compound pills of galbanum. (Asafœtida, galbanum, and myrrh.) Dose, 1—4 pills.

COMPOSITION.—About one-half of the gross constituents of asafœtida consists of *resin*. This is not wholly soluble in chloroform or ether. It contains a peculiar acid (*firulaic acid*). Asafœtida also contains a sulphuretted and phosphuretted *volatile oil*, in the proportion of from three to five per cent. This oil is at first neutral, but becomes acid by exposure to the air, and evolves sulphuretted hydrogen. It possesses in a high degree the disagreeable odor of the drug.

Asafœtida also contains *malic acid*, and acetic, formic, and valerianic acids, are products of the watery distillation. There is sufficient gum present also to form an emulsion with water.

ANTAGONISTS AND INCOMPATIBLES.—Acids, neutral salts, cold, and arterial sedatives, oppose the action of asafœtida.

SYNERGISTS.—The gum-resins, the balsams, and the aromatics, essential oils containing sulphur and phosphorus, and alcohol and ether, promote the physiological and therapeutical activity of asafœtida.

PHYSIOLOGICAL ACTIONS.—Asafœtida possesses an extremely characteristic odor, and a pungent, rather hot, and faintly acrid taste. It excites by its presence in the fauces an increased flow of saliva. It stimulates secretion from the gastro-intestinal mucous membrane, promotes the appetite, improves digestion, and increases peristalsis. The fæces are somewhat softer, and are very offensive from the presence in them of sulphur and phosphorus compounds, resulting from the decomposition of the essential oil. In large quantity asafœtida causes nausea, vomiting, and purging. The active principle (the essential oil) undoubtedly slowly diffuses into the blood, for the odor of it is detectable in the sweat and breath. Increased action of the heart, a higher temperature of the surface (subjectively, at least), more or less diaphoresis, and diuresis, have been observed to follow its medicinal administration. It acts as a gentle stimulant to the brain, induces a feeling of well-being, increases the flow of ideas, and causes, as the author has observed in one case, certainly, sufficient exhilaration of a pleasant kind to be regarded as an intoxicant.

Asafœtida is eliminated by the skin, intestinal and bronchial mucous membrane, and in small part by the kidneys. The functions of all these parts are increased in activity by the local stimulant effect. Partly due to the general rise of arterial pressure which it produces, partly to its local action in the process of elimination, and partly to its phosphorus compounds, asafœtida increases the menstrual flux, and, in both sexes, the venereal appetite.

THERAPY.—Asafœtida is used in the country of its habitat as a *condiment*. A little—very little—rubbed on the gridiron, improves the flavor of beefsteak. If it were not for its intolerable odor, and for the horrible eructations which follow its use, even when disguised in a sugar-coated pill, it would be much employed as a *stomachic tonic* in *atonic dyspepsia* accompanied by torpor of the intestines. For the *flatulent colic of infants* no remedy is better than *mistura asafœtidæ*, which may be given in teaspoonful doses. It is especially in the *flatulence of hysteria and hypochondriasis* that this remedy is serviceable. It expels the flatus, promotes intestinal secretion and digestion, and relaxes the bowels. In this way the mind is relieved, but the action of asafœtida extends beyond this improvement in the state of the chylopoëtic viscera—it induces a condition of mental cheerfulness which takes the place of the abnormal mobility of *hysteria*, and of the gloom of *hypochondriasis*.

The officinal pill of aloes and asafœtida is an excellent combination for the relief of *constipation*, when associated with *amenorrhœa*. It is adapted, of course, to those cases in which there is a condition of anæmia rather than of plethora, and in which there exists a state of torpor of the ovaries, as well as of the intestinal canal. These conditions existing, the combined pill of aloes and asafœtida is indicated whether hysteria be present or not.

The *chronic scaly eruptions*, *chronic eczema*, etc., especially when the skin is dry and harsh, are much improved by the persistent use of asafœtida.

Bronchorrhœa, *bronchitis* after the acute symptoms have subsided, the *cough maintained by habit* which may succeed the whooping-cough, and the *sympathetic cough of mothers*, whose children are experiencing whooping-cough, are greatly benefited by asafœtida. ℞. Mist. asafœtidæ, ℥ iv; ammonii muriat., ʒ j. M. Sig. *A tablespoonful as necessary.*

Asafœtida, which was formerly much prescribed in *asthma*, *whooping-cough*, and other neuroses of the respiratory organs, has been supplanted by more efficient remedies.

The disagreeable odor of asafœtida, which is a bar to its employment in many of the diseases to the treatment of which it is very well suited, is not an objection to its use in *hysteria*, *hypochondriasis*, and *epilepsy*. The moral effect of its repulsive odor is not without influence in the psychic realm. But the effect of asafœtida is not simply on the imagination of the patient; it has constituents of very positive quality, which impress the brain. Hence the utility of asafœtida to arrest the *hysterical paroxysm*, and to relieve the numerous maladies in which the hysterical constitution disports itself. The remarks already made in regard to the action of asafœtida on the digestive functions in hypochondriacal subjects, render it unnecessary to speak more at length on the use of this remedy in *hypochondriasis*. Asafœtida is no longer employed in the treatment of *epilepsy*, except in the so-called *hystero-epilepsy*. The *convulsions of childhood*, from reflex irritation, are sometimes relieved by this remedy, but it is entirely without utility in convulsions arising from renal or cerebral disease.

Ammoniacum.—Ammoniac. A gum-resinous exudation from dorema ammoniacum. *Gomme ammoniaque*, Fr.; *Ammoniakgummi*, Ger.

Emplastrum Ammoniaci.—Ammoniac-plaster.

Mistura Ammoniaci.—Ammoniac-mixture. (The resin is suspended by the gum in water.) Dose, ℥ ss — ℥ j.

Pilulæ Scillæ Compositæ.—Compound pills of squill. (Squill, ginger, ammoniac, and soap.) Dose, 1—2 pills.

COMPOSITION.—Ammoniac contains a volatile oil, which differs from the asafœtida oil in not containing sulphur. It has the odor of the drug. Ammoniac also contains gum and resin, the latter in the proportion of about seventy per cent.

ANTAGONISTS, INCOMPATIBLES, AND SYNERGISTS, same as for asafœtida.

PHYSIOLOGICAL ACTIONS.—The effects of ammoniac are similar to those of asafœtida, but it is much less active, owing to the fact, chiefly, that its volatile oil does not contain sulphur and phosphorus compounds.

THERAPY.—Ammoniac may be used for the same purposes as asafœtida, but it is much less efficient than the latter. At present its use is almost entirely restricted to *chronic bronchial affections*, in which the *mistura* is prescribed usually with the carbonate or chloride of ammonium. Ammoniac-plaster is sometimes used as a discutient to indolent glandular and inflammatory swellings.

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Valeriana.—Valerian. The root of valeriana officinalis. *Valériane*, Fr.; *Baldrianwurzel*, Ger.

Infusum Valerianæ.—Infusion of valerian. (℥ ss—O j.) Dose, ℥ ss — ℥ ij.

Extractum Valerianæ Fluidum.—Fluid extract of valerian. Dose, ʒ ss — ℥ ss.

Tinctura Valerianæ.—Tincture of valerian. (℥ iv—O ij.) Dose, ʒ ss — ʒ ij.

Tinctura Valerianæ Ammoniata.—Ammoniated tincture of valerian. (℥ iv—O ij spts. ammon. aromat.)

Ammonii Valerianas.—Valerianate of ammonia. "Is a white salt, in the form of quadrangular plates, having the disagreeable odor of valerianic acid, and a sharp, sweetish taste. It deliquesces in a moist air, but effloresces in a dry one, and is very soluble in water and in alcohol. It is decomposed by potassa, with evolution of ammonia, and by the mineral acids with separation of valerianic acid, which rises to the surface in the form of oil."

Oleum Valerianæ.—Oil of valerian. Dose, m. ij—m. iv.

Composition.—Valerian contains from one to two per cent. of an *essential oil*, which, if distilled from the perfectly fresh plant, has but little odor. In the process of drying of the root, or on exposure to the air of the oil distilled from fresh roots, *valerianic acid* is formed. As obtained from the dried root, the oil of valerian consists of *valerianic acid*, a *camphor*, *valerene*, and *valerol.*

An acid strongly resembling valerianic is obtained by the oxidation of amylic alcohol; but the two acids are not identical. The valerianic acid of pharmacy is, however, obtained in this way, and the various valerianates are products of the combination of the acid formed from amylic alcohol, with bases.

Antagonists and Incompatibles.—Quinine, digitalis, ergot, and remedies acting similarly, antagonize the actions of valerian.

Synergists.—All the agents of this group, opium, alcohol, ether, etc., increase the action of valerian.

Physiological Actions.—Valerian and its preparations have a hot, pungent taste, and a peculiar and disagreeable odor. A sensation of warmth at the epigastrium follows when it is taken into the stomach. In large doses, nausea, hiccough, eructations of the drug, vomiting, and diarrhœa, may be produced. In small doses no appreciable physiological effects are observed; but in considerable doses the action of the heart is increased, the temperature of the surface rises, and diaphoresis occurs. As respects the nervous system, headache, vertigo, exhilaration of mind, spectral illusions, hallucinations, have, it is said, been produced by valerian; but these results are by no means constant phenomena. According to Von Grisar (Köhler) oil of valerian reduces the reflex excitability, motility, and sensibility, and antagonizes the tetanizing action of brucia.

The odorous principle—valerianic acid—appears in the sweat, breath, and also the urine.

Therapy.—*The flatulence of the hysterical and hypochondriacal* is quickly relieved by the tincture or fluid extract of valerian.

It sometimes happens that a mild attack of *spasmodic asthma* may be relieved by valerian, but this by no means efficient remedy quickly loses its effect. *Whooping-cough*, *laryngismus stridulus*, and other *neuroses of the respiratory organs*, may be occasionally modified by this agent; but it is by no means equal to many other remedies now available.

The chief therapeutic use of valerian is in the treatment of *nervousness*, *hysteria*, and *hysterical disorders generally.* There can be no difference of opinion as to its great value in these cases; but as respects *epilepsy*, *chorea*, *paralysis agitans*, etc., in which it was formerly used, it must suffice to say that it is now never prescribed.

Under the impression that the physiological and therapeutical activity of valerian depends on valerianic acid, various valerianates have been introduced into practice. The only one which requires notice here is the *valerianate of ammonia*, which in the form of elixir is frequently prescribed in hysterical affections. It is not nearly so effective as the tincture, the fluid extract, and the oil of valerian, for a very obvious reason: valerianic acid is associated in the drug with several important constituents which undoubtedly contribute to its therapeutical powers. The valerianate of ammonia is not unfrequently successful in the treatment of *nervous headache*.

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KÖHLER, DR. HERMANN. *Handbuch der physiologischen Therapeutik*, etc., erste Hälfte.
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Serpentaria.—Serpentaria, Virginia snake-root. The root of aristolochia serpentaria, of aristolochia reticulata, and of other species of aristolochia. *Racine de serpentaire*, Fr.; *Virginische Schlangenwurzel*, Ger.

Infusum Serpentariæ.—Infusion of serpentaria. (℥ ss—Oj.) Dose, ℥ ss—℥ ij.

Extractum Serpentariæ Fluidum.—Fluid extract of serpentaria. Dose, ʒ ss—ʒ ij.

Tinctura Serpentariæ.—Tincture of serpentaria. Dose, ʒ ss—ʒ ij.

COMPOSITION.—Serpentaria contains a volatile oil, resin (a camphor), and a bitter principle, *aristolochine*, which is similar to quassine.

ANTAGONISTS AND INCOMPATIBLES.—The addition of water to the tincture renders it turbid. As the preparations of serpentaria contain tannin, the salts of iron are incompatible with them. Arterial sedatives, depressants, ergot, etc., are opposed, physiologically.

SYNERGISTS.—Camphor, valerian, ammonia, alcoholic stimulants, opium, favor the action of serpentaria.

PHYSIOLOGICAL ACTIONS.—Serpentaria has a warm, camphoraceous, pungent taste, and a characteristic odor. In small doses it increases the appetite, promotes secretion from the intestinal mucous membrane, and relaxes the bowels. In large doses it excites decided irritation, resulting in nausea, vomiting, and diarrhœa.

The action of the heart, the cutaneous circulation, and the temperature, are elevated by serpentaria. It promotes secretion from the bronchial mucous membrane, and is expectorant.

Fullness of the head, headache, vertigo, exhilaration, are produced by full doses. As a rule serpentaria increases the urinary secretion, and it has very decided aphrodisiac effects. Increased vigor of the erections and priapism in the male, increased menstrual flow in the female, have been noted from its use in considerable doses.

THERAPY.—The therapeutical applications of serpentaria are deducible from its physiological actions. It is a *stimulant expectorant* of very considerable value. In *capillary bronchitis*, *typhoid pneumonia*, and *chronic bronchitis*, it sustains the powers of life, and promotes expectoration. In the acute pulmonary inflammations it is frequently prescribed with carbonate of ammonia, when stimulants of this kind are required. ℞. Infus. serpentariæ, ℥ iv; ammonii carbonat., ℈ij. M. Sig. *A tablespoonful every three hours.* This combination is especially serviceable about the period of crisis in pneumonia; it lessens the depression which ensues from the rapid defervescence of the fever, and it hastens the transformation of the inflammation products and favors their elimination. Most excellent results are obtained by the use of serpentaria with carbonate of ammonia in the *capillary bronchitis of children.* ℞. Ext. serpentariæ fluid., ℥ ss; ammonii carb., ʒ ij; syrp. tolutan., ℥ iss. M. Sig. *A teaspoonful every two, three, or four hours.* In *diphtheria*, *scarlatina*, and other exanthemata, when there exists much depression, serpentaria is a useful stimulant. The infusion is an excellent detergent application to the throat (as a gargle) in the above-mentioned disorders with local manifestations in the fauces.

In *typhoid*, *typhus*, and *remittent fevers*, serpentaria is indicated, and is unquestionably serviceable when much depression exists. It is apt to increase the diarrhœa of typhoid, however, and must be given with caution when the intestines are very irritable. It has been asserted that serpentaria has decided antiperiodic powers and it enters into the composition of Huxham's tincture, but it is greatly inferior to many other antiperiodics without reference to quinia.

The emmenagogue properties of serpentaria render it useful in *amenorrhœa* of anæmia and chlorosis. When relaxation of the genital organs, feeble erections, and too ready ejaculation, render intromission uncertain, serpentaria will not unfrequently afford relief and restore the waning sexual power.

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PORCHER, DR. FRANCIS PEYRE. *Resources of the Southern Fields and Forests*, p. 898.
STILLÉ, DR. ALFRED. *Therapeutics and Materia Medica*, fourth edition.
UNITED STATES DISPENSATORY, thirteenth edition.

Cannabis Indica.—Indian Hemp. *Chanvre Indien*, Fr.; *Hauf-kraut*, Ger.

Cannabis Americana.—American Hemp.

COMPOSITION.—The physiological activity of hemp is influenced largely by soil and climate; for, although in botanical characters Indian and American hemp are identical, the Indian hemp possesses decidedly more narcotic power. Indeed, until recently, it was supposed that American hemp was devoid of the peculiar properties possessed by the Indian. We owe to H. C. Wood the demonstration of the fact that American hemp does really have effects similar in kind to, but much less in degree than, those caused by the Indian.

The most important constituent of hemp is a peculiar *resin*, which possesses the active powers of the plant. By distillation of the leaves and stems, a peculiar *volatile oil* is obtained; and this is divisible into *cannabene*, a very light hydro-carbon, and *hydride of cannabene*, a solid crystalline substance.

An impure resin, collected in an imperfect and crude way from the leaves and stems, is known as *charas*, or *churrus*. *Bhang* consists of the dried leaves and stalks made into a confection with preserved fruits and aromatics, and, in this form, constitutes the well-known *hashish*. *Gunjah* is the female, flowering plant, dried, from which the resin has not been extracted.

PREPARATIONS.—*Tinctura Cannabis Indicæ.* Tincture of Indian hemp. Dose, 10 minims to 60 (480 grains of extract—Oij alcohol).

Extractum Cannabis Americanæ.—Extract of American hemp. Dose, half-grain to two grains, or more.

Extractum Cannabis Indicæ.—Extract of Indian hemp. Dose, half-grain to two grains, or more.

No arbitrary rules for the dose can be laid down. In beginning the use of any newly-made preparation, it is safer to commence with the minimum dose. Having, by gradually increasing the quantity, ascertained the physiological activity of that particular specimen, it may then be pushed according to the necessities of the case.

ANTAGONISTS AND INCOMPATIBLES.—The caustic alkalies, the acids, strychnia, and induction electricity, oppose the actions of hemp. In cases of poisoning, the stomach should be evacuated, and symptoms be combated as they arise. Strychnia may be injected hypodermically, and the respiration be maintained by faradization of the respiratory muscles. As, however, hemp possesses but feeble toxic power, cases of acute poisoning have never been reported.

SYNERGISTS.—Alcohol, ether, nitrous oxide, the mydriatics—belladonna, hyoscyamus, etc., opium, and the cerebral stimulants generally, promote the actions of hemp.

PHYSIOLOGICAL ACTIONS.—The resin of hemp is a soft solid; is soluble in alcohol and in ether, in the fixed and volatile oils, and in the fats.

It has a balsamic taste, but is bitter and acrid. It promotes the appetite and the digestion somewhat. The most important actions are those referable to the nervous system. There is a distinction to be made between the effects on the nervous system of the inhalation of the fumes of hashish and those effects which follow the stomach administration. Inattention to this point has, probably, given rise to most of the confusion regarding the physiological actions of this remedy. When inhaled it produces a singular muscular erythism and agitation, a great desire for muscular activity and motion, an entire absence of the sense of fatigue; but these sensations are followed by exhaustion, even by syncope. Hallucinations occur, but they are not usually agreeable; they are often painful, and are replaced by stupor.

By the stomach, and in moderate doses, hashish is an excitant of the nervous system, increasing intellectual and motor activity. In large doses, it lowers the tactile sense and the sense of pain—in other words, it is analgesic and anæsthetic—and it induces a cataleptic state, in which the muscles maintain any position in which they may be placed. The mental intoxication is ordinarily of an agreeable kind; the ideas flow more easily, are highly pleasurable, and are usually accompanied by bursts of gay laughter. Not unfrequently the excitement takes the form of a furious delirium, in which acts of violence are committed—whence the name "haschaschins," or assassins, applied to the unfortunate hashish-eater who, under the influence of the drug, commits murder. It has been maintained, and probably rightly enough, that the form which the delirium takes represents the mental and moral condition of the individual in his normal state: those who are amiable and gay become more so under the influence of hashish; and those possessed of evil and malignant dispositions enact deeds of violence.

Under the influence of hashish the knowledge of time is lost; such are the number and variety of the images which occupy the mind, that a few minutes appear to be hours, days, or even years. After the effects of the drug have passed off, the hashish-eater is usually unconscious of the events that have transpired. Sleep or coma, according to the dose, ends the effects of the drug.

Dilatation of the pupil, and disorders of vision, which contribute to the hallucinations by the distortion of external objects, are produced by hemp. Aphrodisiac effects are said to follow the use of hashish; but impotence, which is common in hashish-eaters, doubtless results from the repeated over-stimulation of the sexual organs.

It is not known by what organs, or in what form, hashish is eliminated. The effects of a large dose are not entirely expended in twenty-four hours, and those who have taken it by way of experiment have suffered vertigo, headache, and other cerebral symptoms, for some time subsequently. It does not increase any of the secretions, except it may be the urinary, somewhat; and it does not stimulate into increased activity any organs except the cerebro-spinal and the sexual. The sleep or stupor which it produces, and which comes on after the stage of excitement, is not followed by after nausea and depression, as in the case of opium.

THERAPY.—The extract of cannabis Indica enters into the composition of chlorodyne, a nostrum which has had a great reputation as an anodyne and hypnotic. In *cholera morbus* and *diarrhœa* this remedy has been used successfully, but we now possess more efficient ones.

Before the days of anæsthesia, and in very remote times, the fumes of hashish were employed to stupefy and to render painless surgical operations. It was also employed to relieve *pain*, and as a substitute for opium in *neuralgia*, and as an *hypnotic*. We possess now so much more efficient remedies that cannabis Indica is rarely, if ever, employed for these purposes. Cases of melancholia are sometimes relieved by it. It has been used, more or less, in the treatment of *chorea*, in *senile trembling*, in *epilepsy*, etc., but with results that do not recommend its employment. About one-half of the cases of *tetanus*, for which hemp was much prescribed a few years ago, got well under its use; but more accurate knowledge of the natural history of this disease has shown that many cases tend to recovery without aid of medicines. It has been used successfully in *trismus neonatorum*.

At the present time the therapeutical employment of hemp is almost entirely restricted to the treatment of certain *uterine maladies*. It is well established that hemp has the power to promote uterine contractions. It cannot initiate them, but increases their energy when action has begun. It may be given with ergot.

In consequence of this power which it possesses to affect the muscular tissue of organic life, hemp is used successfully in the treatment of *menorrhagia*. It is said to be especially useful in that form of *menorrhagia* which occurs at the climacteric period (Churchill).

There can be no doubt that cannabis Indica is a useful remedy in cases of *impotence*. It need hardly be stated that it is adapted to the functional disorder. It may be advantageously combined with ergot and nux-vomica in this malady; for example: ℞. Ext. cannabis Indicæ, gr. x; ergotin. (aq. ex.), ℈ij; ext. nucis vom., gr. x. Ft. pil. no. xx. Sig. One morning and evening.

This agent has also been used with success in the treatment of *gonorrhœa*. It diminishes the local inflammation, allays chordee, and lessens the pain and irritation, with the accompanying restlessness.

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FLUCKIGER AND HANBURY. *Pharmacographia*, p. 491.
GUBLER, PROF. A. *Codex Medicamentarius*, p. 151.
WOOD, H. C. *Therapeutics and Materia Medica*.

Coca, or Cuca.—The leaves of Erythroxylon Coca (unofficinal).

Preparations.—Infusion; fluid extract. The fluid extract is the most eligible preparation, if carefully prepared. The dose of the fluid extract for an adult is ʒ ss—ʒ ij.

Composition.—The effects of coca, or cuca, depend on the presence of a peculiar alkaloid—cocaine. It contains also an aromatic oil which gives it the special aroma and taste, and it possesses considerable astringency, due to the presence of a tannic acid. The odor, taste, and appearance of the infusion, are comparable to those of tea. Cocaine has decided basic properties, and combines with acids to form salts. It crystallizes in prisms in the smaller rhombic system (Husemann), which, when pure, are transparent and colorless. It is very slightly soluble in water and in alcohol, but dissolves freely in ether. It has a bitter taste, and the salts are more bitter than the alkaloid itself.

Antagonists and Incompatibles.—The actions of coca are opposed by all those agents which increase waste. The infusion and fluid extract are incompatible with the metallic salts. Muriatic acid splits cocaine into benzoic acid, and an alkaloid—ecgonin ; hence the mineral acids should not be prescribed with the infusion and fluid extract.

Synergists.—The agents promoting constructive metamorphosis, caffein, the cerebral stimulants, and the narcotics generally, increase the effects of coca.

Physiological Actions.—The historical notes of Sir R. Christison show that the peculiar properties of cuca-leaves have long been known to the inhabitants of Peru. The leaves have a strong, tea-like odor, and the infusion resembles ordinary tea in taste. The volatile oil and the active principle are readily diffusible, and enter the blood with facility. A momentary depression of the pulse and diminution of the blood-pressure take place, but these effects are quickly overcome, and a considerable increase in the action of the heart, and of the blood-pressure, follows (Ott). A feeling of contentment and of well-being takes possession of the mind, the sense of fatigue is removed, drowsiness is experienced for a brief period, but it is soon succeeded by wakefulness, and increased mental activity. It has long been known to the mountaineers of the Peruvian Andes that chewing cuca-leaves increases the respiratory power, and removes, or lessens, the sense of fatigue. The celebrated pedestrian, Weston, having learned this fact, was detected in the use of cuca during one of his extraordinary feats in London (Thompson).

As respects the action of cocaine on the nervous system, it has been demonstrated that it diminishes the excitability of the motor nerves, and impairs the power of voluntary coördination. Its influence on the sensory nerves depends on the quantity of the drug ingested ; a small quantity increases the excitability of the sensory nerves, whereas a large quantity causes paralysis (Ott). It is not known whether or not the paralysis is the result of over-stimulation, and an exhaustion of the sensibility. The posterior columns of the spinal cord are chiefly affected. The paralysis of the heart which ensues from a large quantity seems to be due to an action on the intra-muscular ganglia of this organ. It first excites, then paralyzes, the respiratory centre.

The most interesting question connected with the action of cuca is its influence over the metamorphosis of tissue. It certainly lessens urea-elimination. As is the case with coffee and tea, cuca acts as an indirect nutrient, by checking waste, and hence a less amount of food is found necessary to maintain the bodily functions. It is probable that some of the constituents of cuca are utilized in the economy as food, and that the retardation of tissue-waste is not the sole reason why work may be done by its use which cannot be done by the same person without it.

THERAPY.—Although cuca possesses valuable powers as a restorative, but little use has been made of it, except by the French. It will, no doubt, be found useful in *phthisis*, and *wasting diseases* generally, and in *convalescence from acute maladies*. It is a valuable remedy in the nervous form of sick-headache, *migraine*.

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CHRISTISON, SIR ROBERT. *The British Medical Journal*, April 29, 1876.

HUSEMANN, DRS. AUGUST UND THEODOR. *Die Pflanzenstoffe*, p. 89.

OTT, DR. ISAAC. *Cocain, Veratria, and Gelsemia.* Philadelphia: Lindsay & Blakiston, 1874.

THOMPSON, MR. J. ASHBURTON. *The British Medical Journal*, March 11, 1876, and March 18, 1876.

Caffein.—An alkaloid, found in the Caffea Arabica.

PREPARATIONS.—Citrate of caffein. Dose, gr. j—grs. v.

PROPERTIES.—Caffein crystallizes in needle-shaped crystals, and in prisms, the form depending on the mode of evaporating a concentrated solution. It has a bitter and disagreeable taste, and is soluble in water, alcohol, and ether. As regards composition, caffein is remarkable for the quantity of nitrogen which it contains, surpassing in this respect almost all the alkaloids. In the coffee-bean, caffein exists in combination with a peculiar acid, caffeic, and with caffeo-tannic acid.

ANTAGONISTS AND INCOMPATIBLES.—Tannic acid, iodide of potassium, and the salts of mercury, precipitate caffein from its solution in water. Physiologically, it is antagonized by opium (Bennett).

SYNERGISTS.—The actions of caffein are promoted by the agents of this group, and by the mydriatics.

PHYSIOLOGICAL ACTIONS.—The effects of coffee as a beverage have been sufficiently discussed elsewhere.

Caffein, in small medicinal doses, promotes appetite, increases the digestive power by stimulation of the gastric glands, and relaxes the bowels slightly. On the heart it exerts at first a decided stimulant action, and raises the arterial tension; but these effects are succeeded by weakened cardiac movements and diminished blood-pressure, the cardiac muscle and its contained ganglia being both probably paralyzed by it. Respiration ceases before the heart stops in animals poisoned by caffein.

As regards the cerebral effects, it may be stated that, at first, drowsiness occurs; but this is soon followed by wakefulness, excitement, muscular trembling, confusion of mind, hallucinations, and delirium. The cerebral effects terminate in deep sopor, but this is probably the result of exhaustion. Rise of temperature, convulsions, general paralysis, occur when toxic doses are administered to animals; but the temperature declines when paralysis supervenes.

Caffein, in common with tea, cocoa, cuca, guarana, and other agents similarly employed by mankind, possesses the power to check tissue-waste, and to lessen the excretion of urea and the nitrogen of the fæces.

THERAPY.—Caffein is a useful *stomachic tonic.* In convalescence from acute maladies, it is in a high degree serviceable, given to promote the constructive metamorphosis. *Chronic catarrh* of the stomach, with occasional attacks of *migraine*, is a combination of maladies in which caffein is especially useful. Paullinia, or cuca, may be used instead of caffein.

In the *diarrhœa of phthisis*, in ordinary *atonic diarrhœa*, in *cholera infantum*, and in *cholera morbus*, produced by agencies affecting the nervous system, the remedies of this group, especially caffein, are often extremely useful. When the vital powers are depressed, and when there is at the same time an abnormal excretion of urea—a condition of things which exists in incipient phthisis, associated with indigestion—caffein, cuca, and paullinia, are in a high degree serviceable. They increase the appetite and the digestive power, and diminish tissue-waste.

Black coffee, or caffein, increases the action of the heart, and raises the arterial tension, and is therefore useful when the circulation is depressed from various causes.

The most important use of caffein, at present, is in the treatment of *headache.* It is adapted especially to the relief of *migraine*, the so-called nervous headache, accompanied with, or without, stomach-derangement. In this disorder we may administer a grain of caffein every half-hour, until the headache is relieved; or the citrate of caffein may be given in an effervescent draught. A very elegant preparation is the granular, effervescent citrate of caffein.

When sick-headache occurs periodically, regulation of the diet, according to the methods set forth in another part of this work, is of the first consequence; but we may contribute very materially to a permanent curative result by giving twice daily, in the intervals between the attacks, from two to five grains of caffein.

The action of opium is antagonized by caffein; hence this agent is employed in *opium narcosis*, and in some cases with success. It may be injected hypodermically when the patient is unable to swallow; but it cannot take the place of atropia.

In *hypochondriasis*, and in *simple melancholy*, caffein has been used with advantage. It may be given to relieve the *drowsiness* which in so many persons comes on after a late dinner. It helps dissipate the *stupor of uræmia.*

Cases of *cervico-brachial neuralgia* have been relieved by the hypodermic injection of caffein.

Guarana.—A preparation of the seeds of paullinia sorbilis. Dose, grs. xv—ʒ j.

Composition.—It contains a principle which has been entitled *guaranin*, and which subsequent researches have proved to be identical with caffein.

Actions and Uses.—The physiological effects of paullinia are due to its alkaloid, chiefly; and, as this is the same as caffein, the observations already made on the latter are equally applicable to the former.

The special use of paullinia is in the treatment of sick-headache or *migraine.* It is adapted to the so-called nervous form of sick-headache, and is less efficient when the attacks are due to stomachal troubles. As it possesses, directly or indirectly, restorative powers, it may be employed to promote constructive metamorphosis. Administered with this view, it may be given with advantage in the *convalescence from acute maladies*, in *incipient phthisis*, and in the *wasting diseases generally.*

The most agreeable form in which to administer paullinia is the elixir, but, as this preparation varies according to the taste, honesty, and skill of the apothecary, the physician needs to be assured of its quality before prescribing.

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Pratt, Dr. *Boston Medical and Surgical Journal*, vol. ii., 1868, p. 6.

Schmiedeburg, Prof. O. *Ueber die Verschiedenheit der Caffeinwirkung an Rana temporaria L. und Rana Esculenta L.*, *Arch. f. exper. Path. u. Phar.*, 1874, p. 63.

REMEDIES WHICH DIMINISH OR SUSPEND THE FUNCTIONS OF THE CEREBRUM AFTER A PRELIMINARY STAGE OF EXCITEMENT.

To this group belong the so-called narcotics, the anæsthetics, and some of those usually classed as antispasmodics. They all agree in these respects: their effects are expended, chiefly, on the nervous system: they first stimulate the functions of the brain, but this stage of excitement, which may be of shorter or longer duration, is followed by sopor, coma, and complete insensibility.

Alcohol.—Alcohol. "Spirit of the specific gravity 0.835. Alcohol is colorless, is wholly vaporizable by heat, and unites in all proportions with water and ether. Diluted with twenty parts of distilled water, it should yield little or no foreign odor."

Alcohol Amylicum.—Amylic alcohol. Fusel oil.

"A peculiar alcohol, obtained from fermented grain or potatoes, by continuing the process of distillation after the ordinary spirit has ceased to come over. An oily, nearly colorless liquid, having a strong, offensive odor, and an acrid, burning taste. Its specific gravity is 0.818, and its boiling-point between 268° and 272°. It is sparingly soluble in water, but unites in all proportions with alcohol and ether. It does not take fire by contact with flame, and, when dropped on paper, does not leave a permanent greasy stain. Exposed to the air in contact with platinum-black, it is slowly oxidized and yields valerianic acid."

Alcohol Dilutum.—Diluted alcohol. Specific gravity, 0.941. Equal parts of alcohol and distilled water.

Alcohol Fortius.—Stronger alcohol. Specific gravity, 0.817.

Spiritus Frumenti.—Whiskey. "Spirit obtained from fermented grain by distillation, and containing from forty-eight to fifty-six per cent. by volume of absolute alcohol."

Spiritus Vini Gallici.—Brandy. The spirit obtained from fermented grapes by distillation, and containing from forty-eight to fifty-six per cent. by volume of absolute alcohol.

Vinum Portense.—Port wine.

Vinum Xericum.—Sherry wine.

Composition.—A large number of bodies have been classed under the generic term of alcohols. A list of the most important of these is subjoined:

Methylic alcohol	CH_4O.
Ethylic "	C_2H_6O or $CH_4O + (CH_2)$.
Propylic "	C_3H_8O or $CH_4O + 2(CH_2)$.
Butylic "	$C_4H_{10}O$ or $CH_4O + 3(CH_2)$.
Amylic "	$C_5H_{12}O$ or $CH_4O + 4(CH_2)$.
Caproic "	C_6

These alcohols are called "homologous," because they are closely related to each other, and differ by the common multiple CH_2. Ethylic is the common or ordinary alcohol, and amylic is an impurity existing in certain alcoholic beverages—for example, whiskey, in which it occurs in consequence of the cupidity of distillers in carrying on the process after all the ethylic alcohol has distilled over. Absolute alcohol should be entirely free from any odor except its native ethereal odor, and no products but carbonic acid and water should result from its combustion.

Whiskey is a solution of alcohol in water (48 to 56 per cent.), but contains various odorous principles and ethers which impart to it its peculiar physical properties. The best specimens, doubtless, contain traces of fusel-oil, and acetic, butyric, and sometimes valerianic acids are present in it. The reactions of these acids with the alcohol result in the formation of various ethers, and hence old whiskey is more fragrant and therefore more highly prized than the recent product of the still.

Brandy is also a solution of alcohol in water (48 to 56 per cent.). It has a wine-like odor, and a hot, astringent taste. It contains a volatile oil, an ether pecular to wines (œnanthic ether), coloring-matters, tannic acid, aldehyde and acetic ether. The color is usually factitious: in *pale brandy*, the color is derived from the cask; in *dark brandy*, from caramel. Brandy is made artificially from high-wines by the addition of an ether (cognac, acetic or nitric), of coloring-matter (burnt sugar), and an astringent to give it the necessary roughness of taste (logwood, catechu, etc.).

PHYSIOLOGICAL ACTIONS.—Alcohol in prolonged contact with the skin, evaporation being prevented, excites a sense of heat and superficial inflammation. It coagulates albumen and hardens the animal textures. The epithelium of the mouth is corrugated by it—a result due to the abstraction of water and condensation of the albumen. In the stomach alcohol causes a sense of warmth, which diffuses over the abdomen, and is quickly followed by a general glow of the body. In moderate quantity it induces a superficial congestion of the mucous membrane—a dilatation of the arterioles—and this increased blood-supply enables the mucous follicles and the gastric glands to produce a more abundant secretion. The increased formation of the stomach-juices is doubtless somewhat determined by the stimulation of the mouths of the glands, in accordance with a well-known physiological law. The excitation of the gastric mucous membrane, when habitual, results in important changes; a gastric catarrh is established, for the mucous follicles, under the influence of repeated stimulation, pour forth a pathological secretion. The gastric glands at first simply produce an increased amount of gastric juice, but abnormal stimulation results in pathological changes in this secretion. The increased blood-supply to the mucous membrane sets up an irritation of the connective tissue, which undergoes hyperplasia; the proper secreting structure is encroached upon, and the glands undergo atrophic changes which result in still more important modifications of the gastric juice. Alcohol also affects directly the constitution of the gastric juice by precipitating the pepsin from its solution and by arresting the activity of this ferment.

In small doses, not too frequently repeated, alcohol increases the digestive power by stimulating the flow of blood and soliciting a greater supply of the stomach-juices. Large doses impair digestion directly by precipitating the pepsin, an albuminoid ferment. That a small quantity does not produce the same results in a comparative degree, is simply due to the fact that it is too far diluted, by the quantity of fluid present in the stomach, to act on the pepsin.

The structural alterations induced by the habitual use of alcohol, and the action of this agent on the pepsin, seriously impair the digestive power. Hence it is that those who are habitual consumers of alcoholic fluids suffer from disorders of digestion—gastric catarrh. The abnormal mucus which is elaborated in great quantity, acts the part of a ferment, and the starchy, saccharine, and fatty elements of the food undergo the acetic, lactic and butyric fermentation. Acidity, heartburn, pyrosis, regurgitation of food, and a peculiar retching in the morning (morning vomiting of drunkards) are produced.

As alcohol is a very diffusible substance, it enters the blood with great facility, and probably almost all of that taken into the stomach passes into the blood from this organ, and does not reach the small intestine. The liver is consequently the first organ, after the stomach, to be influenced by the ingested alcohol. The blood of the portal vein, rendered more highly stimulating by the presence of alcohol, increases for the time being the functional activity of the liver-cells, and, as is the case with the stomach, a more abundant glandular secretion follows. Frequent stimulation and consequent over-action result in impairment or loss of the proper function of the part, as is the universal law. The hepatic cells, over-stimulated, produce an imperfect product; they are affected by fatty and atrophic changes, and shrink in size; and the connective tissue of the liver undergoes hyperplasia. The first result of the structural alterations is an increase in the size of the organ; but with the shrinking of the hepatic cells, and the contraction of the newly-formed connective tissue, the liver becomes smaller, nodulated, and hardened. To this change the term *cirrhosis* has been applied. It is essentially a slowly-developing and chronic malady, and long indulgence in alcoholic liquids is necessary to its production.

In small doses alcohol increases the action of the heart and the cutaneous circulation; a slight general rise of temperature is observed; and all of the functious are, for the time being, more energetically performed. If a considerable dose be taken, the phenomena of exhilaration, of excitement, of slight intoxication ensue. A still larger quantity causes loss of muscular power, impaired coördination of voluntary movements, and rambling incoherence. When a toxic dose is taken, the stage of excitement is of short duration; profound insensibility, with stertorous breathing and complete muscular resolution, quickly follow.

As respects the action of alcohol on the nervous system, it is obvious that its first effect is to increase the functional activity of the brain; the ideas flow more easily, the senses are more acute, the muscular movements are more active. These effects are coincident with the increased action of the heart, the slight rise of temperature, and the greater activity of the functions of the organism in general. With the increased action of the alcohol on the cerebrum the excitement becomes disorderly, the ideas incoherent and rambling, the muscular movements uncontrolled and incoördinate (over-stimulation of the cells of the gray matter). With an excessive quantity, the functions of the cerebrum are suspended, and complete unconsciousness ensues; the reflex movements cease; the functions of organic life are performed feebly; and, by an extension of the toxic influence to the centres presiding over these movements, respiration and circulation finally cease.

That these effects on the intra-cranial organs are due to the direct action of the alcohol has been shown. Alcohol has been discovered in the fluid contained in the ventricles, and has been distilled from the cerebral matter; and Hammond has demonstrated that it has a special affinity for nervous matter, being found in the cerebro-spinal axis and in the nerves, in greater quantity than in other tissues of the body. As a result of the direct contact, chiefly, but in part also from the variations in the intra-cranial blood-current, important structural alterations are gradually wrought in the cerebral matter. The cells of the gray matter become more or less fatty and shrunken, the neuroglia undergoes hyperplasia, shrinking and condensation of the whole cerebrum ensue (sclerosis), and the cerebro-spinal fluid relatively increases. The objective evidences of these pathological changes are seen in the impaired mental power, the muscular trembling, the shambling gait, of the drunkard.

In some subjects from sudden excess of a periodical kind, in others, from a failure of the stomach to dispose, not only of aliment, but of the accustomed stimulus, a peculiar morbid state, known as *delirium tremens*, is produced. Peculiarity of the nervous system—idiosyncrasy—is an important factor in the causation of this condition and probably also the use of alcoholic beverages rich in fusel-oil—for Richardson has shown, and the author has repeatedly confirmed the observation, that amylic alcohol causes tremors and muscular twitching "identical with the tremors observed in the human subject during the alcoholic disease known as delirium tremens."

The long-continued action of alcohol on the nervous system produces other disorders besides delirium tremens. Hemi-anæsthesia, epilepsy, paraplegia, amaurosis, etc., have been observed to result from alcoholic excess, and mental alienation, as the asylum statistics prove, has in the same agent its most influential cause.

It is necessary now to consider what becomes of the alcohol after its introduction into the human body, and the influence which it exerts, if any, in the metamorphosis of tissue. The results of experiment on these points have been remarkably contradictory; and the questions involved are by no means settled. It would require a volume to make a satisfactory analysis of the various memoirs and papers which have been published on the actions of alcohol. The author, therefore, merely presents the conclusions to which he himself has come, after a careful consideration of all the more important contributions to the literature of the subject.

A small quantity of alcohol, in a subject not accustomed to its use, causes, as has been already stated, increased activity in all the bodily functions, and slight elevation of temperature. Habit, as is the case with a great many drugs, modifies in a remarkable manner the physiological activity of alcohol, and hence these results are not perceived in the habitual consumers of this substance. Considerable doses of alcohol cause a decline in the temperature of the body, which is even more marked in pyrexia than in the normal state. As respects this effect, the influence of habit is equally great, for in old topers a decline in temperature does not follow the use of alcohol in doses short of lethal. In animals the reduction of the body-heat is more marked than in man. To what cause is the decline in temperature, produced by alcohol, attributable? This is, doubtless, referable to the diminished rate of tissue metamorphosis—for it has been ascertained that the excretion both of urea and of carbonic acid is lessened by alcohol. The combustion of the nitrogen and carbon foods is, therefore, retarded. This action is represented, objectively, by an increase in the body-weight and the *embonpoint* of those who take stimulants moderately.

The disposition of alcohol in the organism is a subject which has gone through several revolutions of opinion. At present the weight of authority and the deductions of experiment are in favor of that view which maintains that, within certain limits (one ounce to one and a half ounce of absolute alcohol to a healthy man), alcohol is oxidized and destroyed in the organism, and yields up force which is applied as nervous, muscular, and gland force. The amount of alcohol ingested, in excess of this oxidizing power of the organism, is eliminated as alcohol by the various channels of excretion—by the lungs, skin, kidneys, etc. As alcohol checks tissue metamorphosis, and thus diminishes the evolution of heat and force, it might be expected that the products of its own oxidation would supply the deficiency, but this is not the case. Alcohol is a useful food in the small quantity which increases but does not impair digestion, which quickens the circulation and gland secretion but does not over-stimulate, and which is within the limit of the power of the organism to dispose of by the oxidation processes. This amount has been pretty accurately shown, as stated above, to be one ounce to one ounce and a half of absolute alcohol for a healthy adult in twenty-four hours. All excess is injurious. North-pole voyages, military expeditions (experiences in India and the Ashantee march), and the diminished power of resistance to cold shown by drunkards, have conclusively demonstrated that alcohol does not supply the place of other foods; and that those habituated to its use, damaged as they are in their vital organs, do not possess the same endurance of fatigue and the same power of resistance to external morbific influences as do the healthy. Furthermore, clinical experience has amply proved that topers do not bear chloroform well, that they succumb more quickly to injuries and surgical operations, and that they possess much less power of resistance than the temperate to the inroads of acute diseases. While these facts rest upon the soundest basis, it is equally true that alcohol is, within certain limits, a food, and that the organism may subsist, for a variable period, on it exclusively.

It is an important clinical fact that the physiological effects of alcohol differ in different conditions of the system. In convalescence from acute diseases, in the sudden depression of the powers of life caused by the bites of venomous snakes, or from loss of blood, or from serious injury, quantities which would, in the state of health, cause profound intoxication, are taken with impunity. The extremes of life—infancy and old age—bear considerable quantities of alcohol well, and are often remarkably benefited by them. Habitual use modifies still more decidedly the immediate influence of this agent on the functions of calorification, of circulation, and of the nervous system.

The differential diagnosis of acute alcoholism (lethal dose), of opium narcosis, concussion of the brain, cerebral hæmorrhage, and hæmorrhage into the pons or medulla, is by no means easy. In the absence of the history, in any given case, it may be impossible to determine. The odor of the breath (of opium or alcohol); the state of the pupil (contracted from opium, unequal, or contracted or dilated from intra-cranial hæmorrhage, contracted or dilated from alcoholic intoxication); the muscular resolution (common to all these states); the slow, sighing, irregular, or stertorous respiration (may occur in either); the abolition of reflex movements (a final symptom in all), are in the nature of things fallacious. A man who has received a concussion of the brain, or had an intra-cranial hæmorrhage, may have taken opium or alcoholic stimulants in quantity sufficient to impart a distinct odor to his breath, without otherwise being distinctly affected by it. The other signs are not sufficient in themselves to enable a decision to be reached. Hence the importance of an attentive examination of the surrounding circumstances. In the absence of a trustworthy history, suspend opinion until the further developments of the case enable an exact diagnosis to be made. The numerous examples of errors fallen into by most competent observers should make the physician hesitate before pronouncing an opinion of "drunk" or "dying," in the sensational language by which some of these cases of mistake have been characterized.

The treatment of acute alcoholism consists in the evacuation of the stomach by the stomach-pump of any unabsorbed alcohol; the *cautious* inhalation of ammoniacal gas; cold affusion to the head; faradisim of the muscles of respiration, external warmth, etc.

As respects the *post-mortem* appearances the following have been observed: intense hyperæmia of the gastric mucous membrane; distention of the right cavities of the heart, and of the great venous trunks; hyperæmia of the cerebral meninges, and serous effusion into the ventricles and subarachnoid spaces.

THERAPY.—Alcohol in small doses is a useful *stomachic tonic.* It is best taken for this purpose after or with meals. It is specially serviceable in the *feeble digestion of old people*, the *atonic dyspepsia of the sedentary, and in the slow and inefficient digestion of convalescence from acute diseases.* It should be prescribed with caution in these cases, especially in the atonic dyspepsia of women and of sedentary men, because of the danger that an alcohol habit may be formed. When it is prescribed in the convalescence of acute diseases, the stimulant should be withdrawn at the earliest period.

Excellent results are obtained from the use of brandy in the *apepsia of infants.* The *summer diarrhœa*, both of children and adults, may be arrested by a full dose of brandy. Irritating matters and undigested food should be removed before the brandy is administered. The vomiting of *cholera-morbus* and of *cholera* may, frequently, be arrested by small doses of iced brandy (a teaspoonful in pounded ice every half-hour), or tablespoonful doses of iced champagne. *Other forms of vomiting*, when due to irritation or inflammation of the stomach—as, for example, the vomiting of pregnancy—can sometimes be promptly cured by the same remedy. It sometimes happens that, in *delirium tremens*, nothing is retained by the stomach, and the life of the patient is put into imminent danger, by reason of the failure of the food-supply to the blood. A little brandy and ice will sometimes settle the stomach under these circumstances, and enable the patient to take and digest the much-needed aliment.

Notwithstanding the theoretical objections which may be urged against this practice, clinical experience is strongly in favor of the use of alcoholic stimulants to counteract the depressing influence of certain agents on the action of the heart—as, for example, *aconite*, *veratrum viride*, *chloral*, *digitalis*, and the *poison of venomous snakes.* Before commencing the inhalation of chloroform, an ounce or two of whiskey or brandy should be given the patient. This serves a double purpose: it sustains the heart and prolongs the chloroform narcosis.

Alcohol in some form is constantly prescribed in low conditions in *fevers*, *acute inflammations*, and *depressing maladies of all kinds*. It is serviceable in these diseases, when it lessens the pulse-rate, but increases the contractile power of the heart and elevates the arterial tension. It does harm when the pulse becomes more rapid and the blood-pressure is lowered by it. It does good when the tongue, before dry, becomes moister under its use, and harm when the dryness of the tongue is increased. It does good when the temperature is reduced, the delirium and subsultus lessened, and the sleep becomes more continuous and refreshing; and does harm when it increases fever, exaggerates the delirium, and induces coma vigil. The chief utility of alcohol in these forms of disease is not as a stimulant, but as a food. It furnishes material, easily oxidizable, which can be applied as nervous, muscular, and gland force. Furthermore it stimulates digestion, and enables more food to be taken and disposed of, and thus contributes indirectly to the maintenance of the powers of life. It follows from these considerations, that alcohol should be given in these low conditions of the organism, with milk, eggs, broth, and other suitable aliment.

Undoubtedly the stimulant treatment of *adynamic states* is often carried to great excess. The large doses of alcoholic substances administered, disorder the stomach and suspend digestion; and thus the condition of things which they are intended to relieve is only made worse. Furthermore, stimulants are excessively used in these disorders, from a wrong notion of their therapeutic action, and a conviction that diseases characterized by depression are best treated by arterial stimulants. The reaction which has set in against the antiphlogistic methods is in part answerable for the great freedom with which alcohol is now used in fevers and inflammations.

As respects its action on the nervous system, alcohol is a narcotic. It may be used to *relieve pain*, to *promote sleep*, and to *quiet delirium*. The various *neuralgiæ* may be temporarily alleviated by intoxicating doses of alcohol, but such a prescription is dangerous to the moral health of the patient. The subjects of neuralgia, or those who possess the neurotic temperament, have as a rule an inherited or acquired weakness of constitution, and a mobility of the nervous system, which render the effects of alcoholic stimulants peculiarly grateful.

When *wakefulness* is due to a condition of *cerebral anæmia*, a full dose of some alcoholic fluid, whiskey or brandy, will procure sound and refreshing sleep. In some subjects a glass of ale or beer answers better. Some cases of *delirium tremens* are greatly benefited by alcoholic stimulants. When the delirium is the result of sudden excess and of the direct action of the alcohol on the cells of the gray matter, the use of this agent will only add to the existing disorder; but when, as is so frequently the case, the attack is determined by the failure of the stomach to appropriate not only the stimulant but the food also, the careful administration of alcoholic stimulants with suitable aliment renders an incontestable service.

As alcohol stops waste, promotes constructive metamorphosis by increasing the appetite and the digestive power, and favors the deposition of fat, it is directly indicated in *chronic wasting diseases*, especially in *phthisis*. Clinical experience is in accord with physiological data: alcohol is an important remedy in the various forms of *pulmonary phthisis*. It is frequently given with cod-liver oil, or an ounce or two of whiskey may be taken with some bitter or aromatic immediately after meals. It is an interesting fact that an intractable form of phthisis is induced by alcoholic excess. If alcohol disagrees, if it does not improve but lessens the appetite, it will do harm in phthisis.

EXTERNAL APPLICATIONS OF ALCOHOL.—Equal parts of alcohol and water is an excellent evaporating lotion for the relief of superficial inflammations—*bruises*, *inflamed joints*, *orchitis*, etc. Alcohol is an excellent *hæmostatic*, for restraining oozing from a large surface. For *suppurating wounds* alcohol is an excellent *antiseptic dressing*—it destroys germs, removes fetor, and stimulates the tissues to more healthy growth. It favors the cicatrization of open wounds by coagulating the albumen and thus making an impermeable covering. It is a useful practice to wash the parts threatened with bed-sores with whiskey or alcohol; it hardens the cuticle, and prevents ulceration. *Sore nipples* may be prevented by washing them with brandy after the child nurses, and then dusting them with bismuth carbonate. Brandy-and-water is an excellent lotion for *mercurial* and other forms of *stomatitis*, requiring stimulant applications. Brandy-and-water is one of the thousand injections used in *gonorrhœa*.

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Vinum.—Wine.

Vinum Portense.—Port wine.

Vinum Xericum.—Sherry wine.

These are the only wines recognized by the United States Pharmacopœia. In medical practice a great variety are employed, in accordance with special indications. It would occupy too much space, and be foreign to the purpose of this work, to enter into details in regard to particular wines, but some attention should be given to the different groups.

Sparkling Wines. (Champagne, sparkling catawba, etc.)—These are wines which have been bottled before the stage of fermentation has been completed, hence they are lively, or sparkling, in consequence of being charged with carbonic acid. A considerable portion of the grape-sugar has not been converted into alcohol; they are sweet wines, therefore, and the quantity of absolute alcohol which they contain is relatively low (eight to twelve per cent.). Sparkling hock is a lighter wine than champagne, and contains less sugar. Sparkling catawba more nearly resembles hock than champagne.

A sophistication now much practised consists in adding to still wines carbonic-acid gas, by pressure, in the same manner that carbonic-acid water is manufactured.

Dry Acid Wines.—The best specimens of this group are the German Rhine and Moselle wines, California hock, and Ohio and Kelly-Island catawba. The German varieties are very numerous, and are remarkable for their flavor, for the completeness of the fermentation (absence of sugar), and for their permanence. The most important of the varieties are the following: Dürkheimer, Ungsteiner, Hochheimer, Deidesheimer, Förster, Rudesheimer, Johannisberger, Liebfrauenmilch, etc. The French wines are, as a rule, rather acid. The best known are the clarets, but these are more properly classed with the red wines.

Sweet Wines.—In this group are contained Burgundy, still champagne, muscatel, malaga, California muscatel, and angelica, Madeira, etc. The alcoholic strength of these wines, unless fortified, is relatively low, because the sugar has not been consumed by the fermentation.

Light Red Wines.—The French clarets, the red Rhine wines, the American Ives's seedling, and Concord and California port, are members of this group. They contain a large proportion of the coloring-matter of the grape, and considerable tannic acid.

Heavy Red Wines.—Port is the principal representative of this group, but it is not a natural wine; during the process of manufacture spirit is added, and its alcoholic strength is raised to thirty or forty per cent. California port when fortified, as it probably frequently is, should be classed in this division.

Dry Spirituous Wines.—The most important member of this group is sherry.

Composition and Properties.—The composition of wine is extremely complex. The constituents ascertainable by chemical analysis do not represent all of the peculiar qualities which render various wines desirable. Bouquet and flavor cannot be determined by the most expert chemist, and elude all other means of investigation but the tongue and nose of the "wine-taster."

A wine is a solution of alcohol in water, mixed with various constituents of the grape. The proportion of alcohol ranges from six to forty per cent.—the largest quantity being found in the artificial wines, such as port and sherry. The proportion of sugar varies greatly—from three to twenty-five per cent. The acids are fixed (tartaric) and volatile (acetic). The relation between these several constituents is nearly as follows: Port contains about fifty-three parts by weight of alcohol to one part of acid, and twelve parts of sugar to one part of acid. The average of sherry is thirty-nine of alcohol and 1.5 of sugar to one of acid. In the sweet wines, the average is about thirty parts of sugar to one part of acid and fifteen parts of alcohol. In the acid wines, the average proportion of alcohol to acid is as eighteen to one, while the sugar is almost absent, and in some of the best is entirely so. Those are *dry wines* which are free from sugar. Besides tartaric and acetic acids, wines contain, in much smaller quantity, malic, tannic and carbonic acids. Wines containing less than three hundred grains of acid to the gallon are wanting in flavor; on the other hand, an excess of acid over five hundred grains to the gallon is too sour to be agreeable. The coloring-matter of wine varies greatly, and the distinction between "white" and "red" depends on the quantity present in these different varieties. The red wines are more astringent, due to the larger proportion of tannin which they contain, and they are also rougher to the taste.

Wine contains a great many mineral constituents: tartrates of potassa and lime, chlorides of sodium, potassium and calcium, and sulphates of potassa and lime. The percentage of ash ranges from 0.18 to 0.40.

The peculiar odor of wine (bouquet) is due to œnanthic acid, and œnanthic ether, produced by a reaction of the acid on the alcohol.

According to Fresenius, the quality of a wine is so much the greater *the less it contains of free acid, the more it contains of sugar, and the greater its quantity of extract;* and, further, its quality is not decidedly influenced by the quantity of alcohol, and cannot be determined by its specific gravity.

A certain quantity of free acid is necessary, but it should not be greater than can be masked by the alcohol, sugar, and extractive matter. The flavor and odor of wine are produced by ethers formed by the action of the free acid on the alcohol; hence the importance of this acid constituent.

Dr. Druitt, in his "Report on Cheap Wines," has very well summed up the qualities of good wine, in the following conclusions:

"1. The wine should have an absolute *unity*, or taste as one whole.

"2. Wine should contain a certain amount of alcohol.

"3. Wine should be slightly sour.

"4. Sweetness is characteristic of a certain class of wines, while certain other wines are *dry*, or free from sugar.

"5. Wines should have a taste free from mawkishness, and indicative of instability.

"6. Roughness or astringency is a most important property, and belongs to most red wines. In moderation it is relished, as sourness is, by a healthy, manly palate, just as the cold souse is welcome to the skin. In excess it leaves a permanent harshness on the tongue.

"7. The wine must have *body*. This is the impression produced by the totality of the soluble constituents of wine—the extractive, that which gives *taste* to the tongue, and which, as wine grows older, is deposited along with the cream of tartar forming the *crust*.

"8. *Bouquet* is that quality of wine which salutes the nose. *Flavor* is that part of the aromatic constituent which gratifies the throat.

"9. The wine must *satisfy*. A man must feel that he has taken something which consoles and sustains. Some liquids, as cider and thin wines, leave rather a craving, empty, hungry feeling after them."

Physiological Actions.—As respects the alcohol which they contain, the physiological actions of wines could be discussed with the previous article. But wines differ from alcohol, and from brandy and whiskey, not only in spirituous strength, but in the possession of the varied and important constituents mentioned above.

The sparkling wines are more sedative to the stomach, and are more intoxicating, relatively to their alcoholic strength, than the other wines. As they contain a considerable quantity of unappropriated sugar, acid fermentation is apt to occur, and acidity, with headache, follows their use. As respects the influence on the pulse, they are less stimulating than the stronger wines, and the experiments of Dr. Edward Smith have demonstrated that they increase the excretion of carbonic acid.

The dry acid wines are more purely stimulant, partly in consequence of their alcohol, and partly in consequence of the important ethers which they contain. As they are free from sugar, acid fermentation does not follow their use, but with some subjects the free acid present in them disagrees.

The sweet wines have, generally, considerable body and alcoholic strength. They rather pall on the appetite; are apt to disorder the stomach, and produce headache. Some of them have fine bouquet and flavor, and are satisfying to the palate; but as a rule they are not borne as well as the dry wines.

The red wines, light and dark, are astringent and have considerable body and alcoholic strength. The tannin which they contain, and coloring-matters, are apt to cause stomach-disorders, constipation, and a febrile state. By reason of the large amount of alcohol in them, especially in port, they approach whiskey and brandy in power as stimulants and narcotics.

THERAPY.—The effervescing or sparkling wines often render important service in irritable states of the stomach without inflammatory action. The *vomiting* of *pregnancy*, of *sea-sickness*, of *yellow fever*, of *cholera-morbus, with depression*, and of *true cholera*, are not infrequently arrested by tablespoonful-doses of iced champagne every fifteen minutes.

A generous glass of a dry wine (sherry) taken with the principal meal greatly assists the digestion of the sedentary who suffer from *atonic dyspepsia*. The wine should be taken during the course of the meal, and at no other time. Persons who suffer from *acidity*, due to an excess of formation of acid gastric juice, are relieved by a dry acid wine, taken during the meal or just previously. For this purpose a genuine Rhine wine—for example, Förster Riesling—is best.

In *diarrhœa* and *dysentery*, after the acuter symptoms have subsided, and when there is considerable depression, those wines are indicated which contain tannin—the red wines, claret, Ives's seedling, port, etc.

In cases of *anæmia and chlorosis*, wines render an important service by increasing digestion and assimilation. To aid in this process, red wines with a good deal of sugar and extractives are most necessary. When wines produce headache, and the digestion is disordered by them, and the appetite impaired, they are not serviceable in these maladies. Moreover, for the nervous and hypochondriacal, wines must be prescribed with caution, for the habit of indulgence is quickly acquired by such subjects. In *convalescence from acute diseases*, there can be no difference of opinion as to the great value of wine as a restorative. Wines of considerable body and alcoholic strength are indicated under these circumstances. When there is much nervous restlessness, wakefulness, and cardiac depression, a wine rich in ethers is specially useful, according to Anstie. In chronic wasting diseases, as *phthisis*, *scrofula*, etc., the stronger wines, as sherry, burgundy, port, may take the place, in some cases, of the spirits, whiskey, and brandy. In these wasting diseases, wines serve a double purpose: they stimulate the activity of the primary assimilation, and within certain limits they are utilized as foods. They are only harmful when digestion is impaired by them; and under no circumstances can they take the place of other aliment.

In *passive hæmorrhages*, in the *hæmorrhagic diathesis* and in *purpura*, wines are indicated, because they elevate the arterial tension, and thus act indirectly as hæmostatics.

In various *acute diseases*, when the *action of the heart becomes feeble* and *irregular*, the *pulse dicrotic*, and there occur *wakefulness* and *delirium*, a wine of considerable alcoholic strength and rich in ethers is peculiarly serviceable. Wines are much more largely used in fevers (*typhoid*, *typhus*, etc.) than in any other forms of disease, and the circumstances requiring their employment are indicated in the preceding sentence. The routine practice of alcoholic stimulation in fevers cannot be justified. Exact indications for the use of wine exist in the state of the heart and arterial system, and of the brain, and these should be sought for in every case, instead of prescribing for the name. In fevers, wines precede the spirituous liquors. The first weakening of the heart's action, the beginning of dicrotism, and the transitory delirium and subsultus, require champagne and the light and acid wines; more profound adynamia, with diarrhœa, the stronger red wines.

In *acute inflammations* (*pneumonia*, *pleuritis*, *peritonitis*, etc.), wines serve to maintain the strength when the powers of life are weakening, or to maintain the functions of brain and heart when crises occur, as in pneumonia. The rules for the administration of wine in acute inflammations are the same as in fevers.

Next to their use in fevers, wines are most frequently prescribed, and with the greatest advantage, in *surgical practice*, for the *consequences of wounds* and *injuries*, to *support the powers of life under protracted and profuse suppuration*, and to favor digestion and assimilation in the course of convalescence from surgical diseases.

The immediate stimulant effect of wine is of great value in *sudden and profuse loss of blood*, whether from injuries and surgical operations, or *post partum*. A highly-etherized wine of good body is most useful here, because it produces a prompt effect and easily yields up the force needed to keep the heart and brain in action, and, in the case of the relaxed uterus, to furnish the power needed to procure its energetic contraction.

Beer, Ale, Porter.—*Beer* and *ale* are fermented liquors made from malted grain, hops and other bitter substances being added. Ale is produced by rapid fermentation, in which the yeast rises to the surface, and beer is the product of slow fermentation in cool cellars, the yeast falling to the bottom. Hence the name *lager-bier*. *Porter* embraces the qualities of beer and ale, and is so named on account of its strong quality, which endeared it to porters.

COMPOSITION.—The proportion of alcohol varies somewhat. In Edinburgh ale it amounts to about six per cent.; in brown stout to six per cent.; in porter to four per cent.; in beer two to three per cent. Besides alcohol and water, these malt liquors contain extract of malt five to fourteen per cent.; carbonic acid 0.16 to 0.60 per cent. In the extract are found also various aromatic substances, lactic acid, potash and soda salts, etc.

PHYSIOLOGICAL ACTIONS.—So far as the alcohol is concerned, beer, ale, and porter correspond in physiological actions to the spirituous liquors and to wines. As they contain malt extract, their nutritive value is greater than spirits and wine. An important constituent, the hop, being an aromatic bitter, the tonic and stomachic qualities of these malt liquors are also greater than their congeners. The process of fermentation, however, lessens in a remarkable degree the nutritive and stomachic qualities of the constituents which enter into the composition of malt liquors. Their value as foods is much exaggerated by the habitual consumers. They increase the appetite and favor the deposition of fat. Although the malt beverages do not cause to anything like the same extent the alterations in the nervous centres produced by the spirituous, they induce other and almost as important structural changes. They set up in the organism fatty degeneration of various tissues, notably of the liver and heart. The habitual beer-consumer is known by his obesity, his flushed face, embarrassed breathing, puffy hands, yellow conjunctiva, etc. The habitual beer-consumer is usually short-lived, and the end is reached by hepatic and cardiac disorders. It is certainly true that a moderate amount of beer may be taken daily, for a lifetime, without any obvious impairment of the functions; but excessive use produces with great certainty the unfavorable effects above described.

THERAPY.—Beer, ale, and porter, are not usually prescribed in acute maladies. They are, however, much and justly esteemed as *stomachic tonics* and *restoratives* in chronic wasting diseases—for example, in *convalescence from acute diseases* and *surgical injuries*, in cases of *profuse* and *protracted suppuration*, *prolonged lactation*, *diseases of the joints*, *scrofula*, *phthisis*, etc.

The malt liquors are harmful in all stomach-disorders with acidity, and in chronic affections of the liver, especially fatty liver. When these beverages do not improve the appetite, when they cause a sense of epigastric oppression, and when they coat the tongue, they are not beneficial.

When *wakefulness* is due to cerebral anæmia, a glass of beer or ale at bedtime will frequently produce satisfactory sleep. *Puerperal mania*, *delirium tremens*, and *acute maniacal delirium*, when these symptoms coexist with a condition of adynamia, are greatly benefited by the liberal use of ale (pale or Edinburgh ale). The effect of this remedy is to arouse the appetite, to quiet delirium, and to produce sleep. In *melancholia*, excellent results are often obtained by the use of porter with a little tincture of opium.

Authorities referred to:

ANSTIE, DR. F. E. *The Medicinal and Dietetic Uses of Wine. The Practitioner*, vols. iv. and v.

DRUITT, DR. R. *Report on Cheap Wines.*

UNITED STATES DISPENSATORY, thirteenth edition.

Æther.—Ether. *Éther*, Fr.; *Aether*, Ger.

A very inflammable liquid, having the specific gravity 0.750. It wholly evaporates in the air and does not redden litmus. When shaken with an equal bulk of water, it loses from one-fifth to one-fourth of its volume.

Æther Fortior.—Stronger ether. "Stronger ether has a specific gravity not exceeding 0.728. It is extremely inflammable and does not redden litmus. Shaken with an equal bulk of water, it loses from one-tenth to one-eighth of its volume. It boils actively in a test-tube, half filled with it and inclosed in the hand, on the addition of small pieces of glass. Half a fluid ounce of the liquid, evaporated from a porcelain plate by causing it to flow to and fro over the surface, yields a faintly aromatic odor as the last portions pass off, and leaves the surface without taste or smell, but covered with a deposit of moisture."

Spiritus Ætheris Compositus.—Compound spirit of ether. Hoffman's anodyne. (Ether, alcohol, and ethereal oil.) "A colorless, volatile, inflammable liquid, having an aromatic, ethereal odor, and a burning, slightly sweetish taste. Its specific gravity is 0.815. It is neutral, or but slightly acid to litmus. It gives only a slight cloudiness with chloride of barium; but when a fluid ounce of it is evaporated to dryness with an excess of this test, it yields a precipitate of sulphate of barium, which, when washed and dried, weighs six and a quarter grains. When a few drops are burned on glass or porcelain, there is no visible residue, but the surface will have an acid taste and reaction. A pint of water, by the admixture of forty drops, is rendered slightly opalescent." Dose m. x—ʒ j.

Spiritus Ætheris Nitrosi.—Spirit of nitrous ether. Sweet spirit of nitre. "Is a volatile, inflammable liquid of a pale-yellow color, inclining slightly to green, having a fragrant, ethereal odor, free from pungency, and a sharp, burning taste. It slightly reddens litmus, but does not cause effervescence when a crystal of bicarbonate of potassium is dropped into it. When mixed with half its volume of officinal solution of potassa previously diluted with an equal measure of distilled water, it assumes a yellow color, which slightly deepens, without becoming brown, in twelve hours. A portion of the spirit in a test-tube half filled with it, plunged into water heated to 145°, and held there until it has acquired that temperature, will boil distinctly on the addition of a few small pieces of glass.

"Spirit of nitrous ether has a specific gravity 0.837, and contains five per cent. of its peculiar ether. It should not be long kept, as it becomes strongly acid by age." Dose, ʒ ss—℥ ss.

Antagonists and Incompatibles.—Ether dissolves iodine, bromine, corrosive sublimate, the volatile and fixed oils, many resins and balsams, tannin, caoutchouc, most of the alkaloids, sulphur, and phosphorus—the last-named two sparingly. As respects its stimulant and anodyne properties, it is antagonized by arterial sedatives, quinia, oxygen, protoxide of nitrogen, the tetanizing alkaloids, strychnia, picrotoxine, etc.

Synergists.—Alcohol and its congeners, chloroform, arterial stimulants, cerebral stimulants, etc., assist the action of ether.

Physiological Actions.—The physiological effects of ether when inhaled require separate treatment; hence the subject of anæsthesia by vapors will be discussed in a special article. It is now proposed to treat of the effects of ether administered by the usual route—the stomach.

Ether has a taste at first sweetish, but afterward hot and pungent. It leaves a cooling sensation in the stomach after the subsidence of the burning, and this quickly diffuses over the body. Increased action of the heart, flushing of the face, warmth of the surface, with increased diaphoresis, follow in a few minutes. The senses are quickly excited, the mind becomes more active, ideas flow rapidly, and the cerebral phenomena of alcoholic intoxication ensue. These effects are of short duration, and a feeling of content, mental calm, and sopor, succeeds to the transient excitement. Ether is eliminated rapidly, chiefly by the lungs, and the whole duration of the effects of even a large quantity (ʒ ij) does not exceed an hour.

Therapy.—Before it is administered, ether should be diluted with alcohol, which renders it readily miscible with water.

A few drops of Hoffman's anodyne (m. x—m. xx) in some camphor-water is an excellent remedy to expel *flatus* from the stomach. *Gastralgia* may often be quickly relieved by the same means. A few drops of ether, added to cod-liver oil, enable the stomach to bear it more easily, and, it is said, favors its digestion; but, that it accomplishes this object by increasing the pancreatic juice, is in the highest degree improbable. Paroxysms of *hepatic colic* are sometimes treated by the internal administration of ether, but this treatment is by no means equal in effectiveness to the inhalation of the vapor. Ether mixed with turpentine has the power to dissolve *hepatic calculi*, hence the remedy of Durande. As Trousseau well remarks, chemical results which take place in the laboratory are not reproduced in the body with equal facility. The rapidity with which ether diffuses into the blood at the temperature of the stomach would appear to preclude the possibility of its exerting any solvent action on a calculus fixed in an hepatic duct. Whatever good result is secured by the administration of the remedy of Durande must be ascribed to the anodyne and anti-spasmodic action of its constituents.

Sudden failure of the heart's action (syncope), from mental emotion or hysteria, is most promptly remedied by the administration of Hoffman's anodyne. Mild attacks of *angina pectoris*, and of *spasmodic asthma*, may sometimes be aborted by a full dose of the ethereal preparations, but these remedies soon lose their effect in these disorders.

Nervous or hysterical sick-headache is quickly cured by ʒ ss doses of spirit of ether. The most important application of these ethereal remedies is in the treatment of the *hysterical paroxysm*. As the action is prompt and quickly expended, it is obvious that ether or Hoffman's drops are only adapted to sudden hysterical seizures, and not to more lasting nervous symptoms arising in an hysterical constitution. Nothing can be more satisfactory than the prompt relief by these agents of *hysterical flatulence*, *globus hystericus*, and *hystero-epilepsy*. ℞. Spts. etheris composit., tinct. valerian. ammon., āā ℥ j. M. Sig. *A teaspoonful in water every fifteen minutes until relieved.*

As a *cardiac stimulant in fevers*, the ethereal preparations are occasionally prescribed. For a quick effect, in an emergency of practice, they are useful, but are not equal to spirits and wine when a sustained effect is required.

Nitrous ether is employed in domestic practice as a mild *diaphoretic*, a *diuretic*, and *carminative*. It no longer occupies the place it formerly held in medical practice, but it is occasionally prescribed in *feverishness*, as a constituent in *expectorant mixtures*, in *combination with diuretic medicines*, etc.

Chloroformum.—Chloroform. *Chloroforme*, Fr.; *Chloroform*, Ger.

Chloroformum Venale.—Commercial chloroform. "A colorless liquid, varying in specific gravity from 1.45 to 1.49. Shaken, with an equal volume of officinal sulphuric acid, in a bottle closed with a glass stopper, it forms a mixture which separates by rest into two layers; the upper one colorless, and the lower one—consisting of the acid—of a brownish hue, which, after the lapse of twenty-four hours, becomes darker but never quite black.

Chloroformum Purificatum.—Purified chloroform. "Purified chloroform is a colorless, volatile liquid, not inflammable, of a bland, ethereal odor, and hot, aromatic, saccharine taste. Its specific gravity is 1.480. It boils at 142°. It is slightly soluble in water, and freely so in alcohol and ether. When shaken with an equal volume of sulphuric acid, in a bottle closed by a glass stopper, and allowed to remain in contact twenty-four hours, no color is imparted to either. When one fluid drachm is evaporated spontaneously with one drop of a neutral, aqueous solution of litmus, the color of the latter is not reddened. The result of the test is the same if the chloroform contained in a white-glass bottle has been previously exposed to direct sunlight for ten hours."

Spiritus Chloroformi.—Spirit of chloroform. (Chloroform, ℥ j; diluted alcohol, ℥ xij.) Dose, ʒ ss — ʒ j.

Antagonists and Incompatibles.—Chloroform separates from the mixture when prescribed with weak spirits or glycerine. It is soluble in alcohol (ten to six), in ether (one to seven), in water (one to two hundred). It dissolves very freely in olive-oil and turpentine, but does not dissolve in or mix with glycerine. It has very extensive solvent power, dissolving caoutchouc, gutta-percha, mastic, tolu, benzoin, copal, among the gums; iodine, bromine, the organic alkaloids; fixed and volatile oils, resins, and fats. In cases of poisoning by the internal administration of chloroform, the treatment should be conducted on the same plan as for irritant poisons. There is no chemical antidote. To overcome its effects on the respiratory and circulatory systems, artificial respiration, cold affusion, and galvanism, may be employed.

Synergists.—Anæsthetic agents, opium, chloral, alcohol, etc., promote the action of chloroform.

Physiological Actions.—The taste of chloroform is hot, sweetish, and pungent. Undiluted it excites violent irritation and inflammation of the mucous membrane. In passing through the fauces the vapor may enter the larynx in such quantity as to cause great heat and inflammation, followed by œdema. In the stomach, chloroform produces a feeling of warmth, followed by coldness, like ether; but, when taken in large quantity undiluted, violent gastritis. Besides the local action, chloroform diffuses into the blood, and affects distant parts. Like alcohol and ether, it increases the action of the arterial system, and occasions excitement of the brain, followed by sopor. In lethal doses profound stupor and insensibility are produced by it.

Therapy.—A little chloroform (m. ij—m. v), dropped on sugar and swallowed, will remove some kinds of *nausea and vomiting.* It can be useful in non-inflammatory states only, as, for example, *sea-sickness*, the *vomiting of pregnancy*, *sick-headache*, etc. *Gastralgia* may sometimes be relieved in the same way. The following formula is an effective remedy for *flatulent colic:* ℞. Spirit. chloroformi, tinct. cardamomi comp., āā ℥ ij. M. Sig. *A teaspoonful every half-hour in water* Hepatic and saturnine colic are also benefited by chloroform, but the addition of opium increases its efficacy, and is usually necessary in these cases. Chloroform is a solvent of *biliary calculi*, and has been prescribed with the view to effect a solution of calculi contained in the gall-bladder, or lodged in the hepatic duct. It undoubtedly affords some relief, but not probably because of its solvent action. As has been remarked of ether, it is in the highest degree improbable that sufficient chloroform, even when it is administered in large doses, can reach the calculus to effect its solution, when experiments out of the body have shown that some hours are required to dissolve a calculus immersed in chloroform. In *irritable ulcer of the rectum*, and *itching about the* *anal region*, an ointment of chloroform gives great relief: ℞. Ung. zinci oxidi, ℥j; chloroformi, ʒj. M. ft. ung. The vapor of chloroform may be applied directly to these parts.

In *hay-asthma*, *whooping-cough*, *spasmodic asthma*, *irritable reflex cough*, the vapor of chloroform may be used as follows: To a cup of warm water, 80° to 100° Fahr., add a teaspoonful of spiritus chloroformi, and repeat every five minutes. This inhalation should not be used except in the presence of a medical man, and not more than five teaspoonfuls should be inhaled at a time. The patient should inhale the vapors as they arise, directing them into the air-passages from the cup by a paper shield. A little chloroform (a minim or two) is a useful constituent of *expectorant mixtures*, when a neurotic element is present.

Chloroform is a very valuable hypnotic in *delirium tremens*. It is unsafe when used by inhalation in the treatment of this affection, but, by the stomach, not unfrequently excellent results are obtained from it. It is contraindicated when there are a vigorous action of the heart, and an elevated state of the arterial tension, and useful when symptoms of depression and adynamia are present. It should be given in the form of the spirit. ℞. Spirit. chloroformi, tinct. capsici, āā ℥j. M. Sig. *A teaspoonful in water every half-hour, hour, or two hours.*

Neuralgia.—Chloroform is extremely valuable in the treatment of this disease, and it is the most effective when used by the method of "deep injection," first proposed by the author. This plan of treatment consists in the injection deeply, *in the neighborhood of the affected nerve*, of five to fifteen minims of pure chloroform. Considerable pain is produced by this injection, swelling of the invaded tissues follows, and a circumscribed induration and numbness are left, but these effects slowly disappear. An abscess may result from the local inflammation, but this is not frequently the case. The author has procured by this means apparently permanent relief to long-standing cases of neuralgic pain (tic-douloureux) affecting the superficial divisions of the fifth. Other practitioners have been equally successful, and the cases thus treated now include neuralgic affections of the most important nerves.

Pain in superficial nerves may sametimes be relieved by the local application of chloroform. ℞. Chloroformi, tinct. aconiti rad., āā ℥ss; liniment. saponis, ℥j. M. Sig. *Liniment.* A piece of flannel, moistened with this, is applied to the painful part, evaporation being prevented by a covering of oiled silk. The pain of *dysmenorrhœa* is relieved by the local application of chloroform-vapor, and of *sciatica*, *lumbago*, *myalgia*, and similar affections, by chloroform applied directly to the parts. *Nervous headache* may sometimes be cured by a little chloroform in a watch-glass applied to the temple.

An impending *paroxysm of intermittent* may be prevented by a full dose of chloroform (ʒj—ʒij) administered before the onset of the chill. The inhalation of chloroform is used for the same purpose.

A few drops of chloroform, frequently repeated, is an excellent means of relief in *cholera.* It allays nausea and vomiting, arrests diarrhœa, relieves the cramps, and restores the temperature. It may be given in the form of spiritus chloroformi, or of chlorodyne, a very celebrated empirical remedy. No single remedy has been more efficacious than chloroform in the treatment of true cholera.

Chloroform as a Counter-Irritant.—When chloroform is applied to the skin and evaporation prevented, it causes heat, redness, and even vesication. Frequently, chloroform is used locally to produce this effect, but usually in combination with other counter-irritants. ℞. Chloroformi, ol. terebinthinæ, āā ℥j; lin. saponis, ℥ij. M. Sig. *Liniment.* ℞. Chloroformi, lin. camphoræ, āā ℥j. M. Sig. *Liniment.* These are elegant counter-irritant applications, in cases requiring the milder remedies of this class, and are used in various internal inflammations and local affections characterized by pain.

Chlorodyne.—This empirical preparation is largely used in cholera, and in painful diseases requiring an anodyne. Numerous formulæ have been published, but none of them appear to possess the exact qualities of the original preparation by Dr. J. C. Browne. The dose of the genuine chlorodyne ranges from ten to thirty drops. The following formula makes a product more nearly resembling the original than any other known to the author:

Chloroform	4 ounces.
Ether	1 ounce.
Alcohol	4 ounces.
Treacle	4 ounces.
Extract of liquorice	2½ ounces.
Muriate of morphia	8 grains.
Oil of peppermint	16 minims.
Sirup	17½ ounces.
Acid. hydrocyan. dil	2 ounces.

Dissolve the muriate of morphia and the oil of peppermint in the alcohol, mix the chloroform and ether with this solution, dissolve the extract of liquorice in the sirup, and add the treacle; shake these two solutions together, and add the hydrocyanic acid. Dose, five to fifteen minims.

Some of the published formulæ contain resin of cannabis Indica, atropia, perchloric acid, in addition to the ingredients above given.

The following formulæ (Fox) are very efficacious in the local affections for which they are recommended:

℞. Chloroformi, m. vj; cucumber cerate, ℥j. M. Sig. *Ointment for pruritus.* ℞. Plumbi carbonat., ʒss; chloroformi, m. iv; ung. aquæ rosæ, ℥j. M. Sig. *Ointment for pruritus.* ℞. Chloroformi, m. viij; glycerin., ʒj; ung. simplicis, ʒvj; potassi cyanidi, grs. iv.

M. Sig. *Ointment for pruritus.* ℞. Morphiæ acetat., 1 part; chloroform, 8 parts; lard, 60 parts; oil of sweet almonds, 40 parts. M. An ointment to be applied several times a day in *pruritus pudendi.*

Authorities referred to:

Bartholow, Dr. Roberts. *On the Deep Injection of Chloroform for the Relief of Tic-Douloureux. The Practitioner*, July, 1874, p. 9.

Gubler, Dr. Adolph. *Commentaires Thérap. du Codex Medicamentarius*, p. 670.

Husemann, Dr. Theodor. *Handbuch der gesammten Arzneimittellehre*, zweiter Band, 1869.

Stillé, Dr. Alfred. *Therapeutics and Mat. Med.*, fourth edition.

Trousseau et Pidoux. *Traité de Thérap. et Mat. Méd.*, eighth edition.

United States Dispensatory, thirteenth edition.

ANÆSTHETICS AND ANÆSTHESIA.

Æther Fortior.—The stronger ether.

Chloroformum Purificatum.—Purified chloroform.

Neither of these anæsthetics should be used until its conformity to the standard of the United States Pharmacopœia has been ascertained. The tests of purity are given under their respective heads in the preceding article.

The term *anæsthetic*, proposed by Dr. Oliver Wendell Holmes, means an agent capable of producing *anæsthesia*, or insensibility to pain. It is true, *anæsthesia* is a term which, according to its etymological signification, should be applied to loss of sensation of touch, chiefly, and *analgesia* should be used to signify loss of the sense of pain; but the word *anæsthesia*, as expressive of the state of profound unconsciousness induced by anæsthetics, is now so firmly established by usage that it were better to retain it. Insensibility to pain (analgesia) may be produced, without simultaneous loss of common sensation, touch (anæsthesia). By the inhalation of ether, chloroform, bichloride of methylene, nitrous oxide, and some other agents, the functions of animal life can be so far suspended that surgical operations involving intense pain, and certain natural processes, accompanied by great suffering, can be performed entirely without the consciousness of the subject concerned.

Physiological Actions.—When the vapor of ether or chloroform is inhaled, a sense of faucial irritation and of the need of air is experienced, and more or less cough is produced. The irritation of the fauces excites the flow of mucus, and the reflex act of swallowing. The feeling of need of air causes the patient to push aside the inhaler or sponge, and in children may lead to violent struggling. The sensibility of the glottis is soon diminished, the coughing ceases, and the inhalation then proceeds quietly.

The first effect is a general exhilaration, the pulse increases in frequency, the respirations become more rapid, and sometimes assume a sobbing or convulsive character; the face flushes; talking, laughing, crying, singing, and sometimes praying, indicate the cerebral intoxication. This stage of excitement varies in duration in different individuals, and is more pronounced in character and more persistent in those of mercurial disposition, and in the hysterical. At this period, although the patient can be easily aroused, sensibility to pain is decidedly diminished; although the sense of touch may be preserved, taste and smell are abolished, and the sight is either abnormally acute or is perverted by illusions. If the inhalation be continued, the patient passes into the condition of complete insensibility. In women and children, and males reduced by illness, the production of insensibility, if the anæsthetic be not inhaled too rapidly, takes place quietly; but, if the subject be a robust male, in full health, especially if the inhalation has been proceeded with rapidly, the stage of insensibility is preceded by a tetanic convulsive stage, in which the voluntary muscular system and the respiratory muscles become rigid, the breathing stertorous, the face cyanosed. This condition of rigidity is similar to, if not identical with, the tetanic stage of the epileptic paroxysm. If the inhalation of the anæsthetic be pushed still further, the tetanic rigidity subsides, the cyanosis disappears, the breathing proceeds quietly, and a condition of complete muscular relaxation, and of abolition of reflex movements, is established. When this is accomplished the arm drops without resistance when let fall, the conjunctiva is insensible to irritation, the pupils do not alter in size when exposed to light, and no mechanical irritation awakens the least consciousness of pain. The surface is cool, and bathed with abundant perspiration, the countenance is placid, the eyes closed, the pupils rather contracted than dilated; the respiration easy, but more shallow than normal; the pulse slower—it may be feebler, it may be stronger than in health. The functions of the cerebrum are suspended; only the lower centres, presiding over respiration and circulation, continue in action. Out of this condition, and without interference, the patient will presently emerge. If, however, the inhalation be continued these organic functions will be suspended, and life will be terminated by the cessation of the action of the heart and of the respiratory organs.

There are several modes of dying from anæsthetic vapors:

1. By the first mode, called by Richardson *syncopal apnœa*, the death is sudden and occurs very soon after the inhalation has begun, and is ascribed by him to "irritation of the peripheral nervous system, accumulation of carbonic acid in the blood, and arrest of the action of the heart." This explanation, the author submits with diffidence, seems very unsatisfactory, for phenomena of this kind, up to the point of cardiac paralysis, must ensue in all cases of chloroform narcosis. The sudden death, at the beginning of inhalation, seems to be more properly explicable on the theory that the first chloroform vapor which reaches them paralyzes the cardiac ganglia, already in an abnormal state of susceptibility from causes not now understood.

2. By the second mode, called by Richardson *epileptiform syncope*, death ensues in the stage of rigidity preceding complete muscular relaxation, and is due to tetanic fixation of the respiratory muscles, and consequent interference with the pulmonary circulation, accumulation of blood on the venous side, and arrest of the heart's action. In these cases respiration ceases before the pulsations of the heart cease.

3. *By paralysis of the respiratory muscles.* Death ensues during the stage of complete muscular relaxation, and the action of the heart continues for some seconds, or even minutes, after respiration has ceased.

4. *By paralysis of the heart.* This also occurs in the course of complete insensibility; the motor ganglia are paralyzed, and the heart suddenly ceases to act, the respiration continuing for a short time longer.

5. This mode of dying is made up of two factors: *depression of the functions* by chloroform narcosis, and the shock of the accident, or the surgical operation. Death may ensue during the inhalation, or may occur afterward.

CONDITIONS OF THE ORGANISM RENDERING THE USE OF ANÆSTHETICS DANGEROUS.—Experience has demonstrated that old drunkards are peculiarly unfavorable subjects. When tumor or abscess of the brain exists, it is dangerous to administer anæsthetics. Instances of sudden death under these circumstances are relatively numerous. Very much enlarged tonsils, swollen epiglottis, œdema of the glottis, are contraindications, but not insuperable, to the use of anæsthetics. Emphysema of the lungs is so frequently accompanied by ischæmia of the arterial, and engorgement of the venous side of the systemic circulation, and with dilatation of the right cavities, that it must be considered a dangerous state in which to administer chloroform, or even ether. Fatty change in the muscular substance of the heart must be considered peculiarly unfavorable, for more deaths have ensued from this cause than any other.

Chloroform and ether have been administered with safety in cases of phthisis and heart-disease (valvular lesions), the muscular substance and its contained ganglia being free from structural change.

Experience has abundantly demonstrated that those reduced by illness and disease, and the feeble, bear anæsthetics better than the healthy and robust; that children and women are better subjects than adults and men; that anæsthetics are safer when given for operations for disease than for injury.

Incomplete anæsthesia is a condition of danger. Numerous accidents have occurred from the use of anæsthetics for trivial operations—notably for extraction of teeth—in which but a partial degree of insensibility is induced. In such cases the heart, enfeebled by chloroform narcosis, is suddenly paralyzed by the reflex action proceeding from the peripheral injury. The district of tissue supplied by the fifth nerve is an especially dangerous region, owing doubtless to the intimate connection of the nucleus of the fifth with the nucleus of the pneumogastric. By far the largest number of fatal cases have resulted from a neglect of this rule: it is never safe to proceed in a surgical operation with anæsthetics, unless complete insensibility has been produced. The author is aware that Trousseau and Pidoux have attributed the number of cases of fatal chloroform narcosis, which have occurred in England, to the fact that the just-mentioned rule is adhered to by English surgeons. Their words are as follows: *En Angleterre, les chirurgiens portent l'éthérisation jusqu'à l'abolition de toutes les facultés animales, jusqu'au commencement de la période d'éthérisme organique. Plus prudents sous ce rapport que leurs confrères de la Grande-Bretagne, les chirurgiens français ont l'habitude de s'arrêter dès que la sensibilité aux excitations de la peau est abolie et que la résolution musculaire commence. Cette prudence explique comment les chirurgiens français ont éprouvé moins d'accidents graves et compté moins de morts subites.* (Vol. ii., p. 322.)

Modes of conducting the Inhalation.—After ascertaining that none of the contraindications mentioned above exist, the patient may be prepared for the inhalation of the anæsthetic vapor. The inhalation should not be proceeded with soon after a full meal. Vomiting, as the narcosis subsides, is usual, and, as the insensibility of the glottis persists for some time afterward, particles of food may be lodged in the chink, causing fatal suffocation. Several cases of this kind have been reported. On the other hand, it is bad practice to administer an anæsthetic after a prolonged period of fasting, for the exhaustion thereby induced may be an influential factor in determining a fatal result. Before the inhalation is begun, it is proper to administer an ounce or two of whiskey or brandy. Much more important is the expedient proposed by the eminent German surgeon, Nussbaum, viz., to administer a subcutaneous injection of morphia. When this is done a much less quantity of the anæsthetic is needed to induce insensibility, and the stage of narcosis is sufficiently prolonged for ordinary surgical operations, without requiring renewed administration of the ether or chloroform.

When the anæsthetic is about to be administered, the operator should, by a cheerful and confident manner, remove the fears of the patient. None of the *paraphcrna* of the operation to be performed should be exhibited before the patient, and no remarks should be made in his hearing regarding his case, the anæsthetic sleep, or the surgical procedure. Only the physician having the administration of the anæsthetic in charge, and the necessary assistants, should be present in the apartment. An abundant supply of fresh air should be insured to the patient, and all the appliances required for resuscitation should be at hand.

The simplest apparatus only is required. Complicated inhalers have, as frequently as the towel or the handkerchief, been used in fatal cases of chloroform narcosis. A cone of stiff paper, lined with lint or felt, and large enough to cover the nose and mouth of the patient, is the best form of inhaler for the administration of ether. Lente's ether-inhaler consists of a cone of hard rubber lined with felt, and having attached to the apex a flexible rubber tube communicating with the ether-bottle. This is a very satisfactory apparatus. When ether is inhaled the atmosphere is, as far as possible, excluded, in order that the anæsthetic effect may be quickly induced. *The important point in the administration of chloroform is to secure such an admixture of atmospheric air as that the amount of chloroform-vapor shall not exceed three and a half per cent.* If this rule be regarded, the form of inhaler is of little importance. The original method of Simpson is as good as any: applying the vapor by dropping slowly chloroform on a piece of thin cloth laid over the mouth and nose, or by a linen handkerchief moistened with half a drachm. The mouth and nose should be protected from the irritant action of the chloroform by inunction with oil.

In administering the vapor of chloroform by any of the modes in use, it should not be forgotten that it has a density and weight four times those of air, and that, consequently, when a cloth or handkerchief is held closely over the mouth the air is displaced, and the patient may be breathing little more than chloroform-vapor.

During the administration of ether, attention should be directed to the state of the respiration, for arrest of the respiratory movements is the only source of danger. When chloroform is being inhaled, the state of the circulation, as well as of the respiratory apparatus, must be regarded.

MEANS OF REMOVING DANGEROUS SYMPTOMS.—Suspension of the heart's action is to be met at once by the withdrawal of the vapor, and the inversion of the patient, according to the method of Nélaton; failure of respiration, by forcibly drawing out the tongue, by the practice of artificial respiration, and by faradization of the respiratory muscles. Artificial warmth should be applied, and cooling of the body by cold-water douche, etc., should be prohibited. Acupuncture of the heart, galvano-puncture, injection of ammonia into the veins, are measures which have been used in extreme cases, but unfortunately rarely with success.

In practising resuscitation for arrest of breathing due to ether, artificial respiration by the method of Silvester, and inversion of the body by the method of Nélaton, are the most promising expedients.

THERAPY.—Anæsthetic agents are used to quiet pain and spasm from disease, to render the dressing of injuries and surgical operations painless, and to produce muscular relaxation. Ether-inhalations give entire relief to the pain of *neuralgia* (*tic-douloureux*), *cancer*, and *in-*

flammation; to pain dependent on spasms—*tetanus*, *chorea*, *hepatic* and *nephritic colic*, etc. It is not necessary in these cases, as a rule, to induce full anæsthesia, for, as has already been pointed out, the sensibility to pain ceases before the condition of insensibility is reached—before, indeed, the perceptive centres of conscious impressions are otherwise impaired than as to the appreciation of pain. Paroxysms of *maniacal delirium*, and of *puerperal mania*, when violent and uncontrollable, are sometimes quickly quieted and refreshing sleep obtained, from which the patient eventually arouses in a calmer frame of mind. Ether is the proper agent for this purpose. It should not be forgotten that *anæsthetics are dangerous in delirium tremens.*

In *puerperal convulsions due to reflex irritation*, or to *uræmia*, the use of chloroform is invaluable. It is equally effective in the *reflex convulsions of early life*, in the *uræmic convulsions of scarlet fever*, and in the so-called *hystero-epilepsy*. When puerperal, or other forms of convulsive seizures, are due to cerebral hæmorrhage, no good can be accomplished by anæsthetic inhalations. In any case, although convulsions may be arrested by anæsthetic inhalations, other appropriate measures must be resorted to for the permanent removal of the causes. A *paroxysm of epilepsy* impending may be aborted by the inhalation of ether, but the nitrite of amyl is a more effective remedy for this purpose.

In certain *neuroses of the respiratory organs*, great relief is obtained by anæsthetic inhalations. *Laryngismus stridulus* may be quickly cured by the vapor of chloroform. A few drops of chloroform on a handkerchief will suffice, and special care should be taken to dilute the vapor largely with air. A similar procedure will relieve severe paroxysms of *whooping-cough*, but a more energetic use of chloroform is required when *convulsions* occur during a fit of coughing. No single agent gives more relief in *asthma*, but, like all other remedies for this disease, the power of relief declines, and increasing doses of the anæsthetic become necessary, so that the habit of chloroform or ether narcosis is formed.

Anæsthetic inhalations should not be recommended in cases which will probably require their use for a long time, because the inclination for this kind of intoxication grows rapidly, and is as difficult to control as the opium-habit. The author has seen one case in which the patient consumed a pound of chloroform daily, but, as might be expected, this extraordinary consumption of the anæsthetic did not long continue, for the patient succumbed in a few months.

In *obstetric practice* the applications of anæsthetics are numerous and important. The indications and contraindications for chloroform in *natural labor* may be formularized as follows: When the labor is of short duration, and not excessively painful, anæsthetics should not be used; on the other hand, when the labor is protracted and the suffering great, they favor the progress of the case and prevent exhaustion and uterine inertia. In *primipara* caution is necessary. The inhalation of the anæsthetic should not begin until near the close of the first stage, unless those painful but ineffectual contractions occur, which have been aptly characterized as "nagging pains," when the vapor, very much diluted, may be cautiously inhaled for their relief. The inhalation should be practised only during the existence of the pain. The influence of the anæsthetic on the pulse, respiration, and uterine contractions, should be carefully observed, and, if the pulse fail, the respirations become shallow, or the pains lose in efficiency, the inhalation should be discontinued. If the anæsthetic cause great excitement, and the patient become loudly clamorous for more, while the uterine contractions are lessening in force, it is doing harm and should be withdrawn. It is never necessary, nor proper, to administer the anæsthetic to complete unconsciousness. Toward the close of the second stage, when the head begins to distend the external parts, the quantity of chloroform may be somewhat increased, but the inhalation should be discontinued when the occiput has passed under the pubic arch. If these rules are followed, the action of the anæsthetic is beneficent. Properly administered the use of chloroform may be considered perfectly safe in the parturient female. It is generally conceded that no well-authenticated case of death from the use of chloroform in labor has occurred, when the administration was in the hands of a properly-qualified medical man.

The following evil results, the author believes, have followed the incautious use of anæsthetics in labor: the progress of the case arrested, so that forceps became necessary; slow and imperfect uterine contraction, and consequent *post-partum* hæmorrhage; a toxic condition of the mother's blood, with after-excitement, wakefulness, and puerperal mania; asphyxia of the child, tedious convalescence, and subinvolution of the womb.

When *instrumental delivery* is required, the utility of anæsthetics is unquestionably great. It facilitates the necessary manipulations, and prevents shock. The inhalation should be carried far enough in these cases to produce sufficient quietude in the patient, but not to complete muscular resolution. When *turning* is to be performed, the state of chloroform narcosis must be deep enough to suspend uterine contractions.

If *puerperal convulsions* occur at any stage, the utility of chloroform is unquestionable. The limits of its utility in these cases have already been indicated.

When careful examination of the pelvic viscera is to be made to establish the diagnosis in difficult and obscure cases, as, for example, *phantom tumor*, *ovarian and fibroid growths*, *pelvic abscess*, etc., the importance of full anæsthesia can hardly be over-estimated.

The use of anæsthetics in *operative surgery* is now an indispensable practice. It may be compendiously stated that ether, or chloroform, is required in all *surgical operations of magnitude*, for the *reduction of dislocations*, for the *taxis in strangulated hernia*, for *dressing painful wounds* and *adjusting fractures*, for *breaking up adhesions*, and *contractions of muscles* and *tendons in cases of deformity*, for *establishing the diagnosis in feigned diseases*, etc.

The after nausea and vomiting, which are sometimes most depressing, and occasionally dangerous, produced by anæsthetics, may be prevented by the hypodermatic injection of morphia and atropia before beginning the administration of the anæsthetic. After the patient emerges from the anæsthetic sleep, the above-mentioned unpleasant after-effects may be relieved by a minute quantity of morphia ($\frac{1}{12}$ of a grain) and atropia ($\frac{1}{125}$ of a grain) injected subcutaneously.

COMPARATIVE UTILITY OF ETHER AND CHLOROFORM.—Chloroform is more pleasant to inhale, and is less irritant to the air-passages than ether. The vapor of chloroform is not, and the vapor of ether is, inflammable, whence it follows that the former may be alone admissible at night under some circumstances. The stage of excitement is longer from ether than from chloroform, but, as ether may be given much more rapidly, this difference in action may be made to disappear in practice. Chloroform is more prompt in its effects, and the narcosis induced by it more sustained, than is the case with ether; but these advantages possessed by chloroform are quite balanced by the greater freedom with which ether may be administered. The danger from the inhalation of chloroform is vastly greater than from ether.

It follows from the above considerations that ether should be used in preference to chloroform, in all cases, except during labor. Chloroform is to be preferred in labor, because more pleasant to inhale, more prompt in action, and without inflammability. The consideration of safety must necessarily take precedence, but experience has shown that chloroform is perfectly safe in labor when properly administered.

The frequency with which fatal cases of chloroform narcosis have been reported—amounting in the aggregate now to about five hundred—imposes an immense responsibility on the administrator. In the present state of opinion on the subject, the use of chloroform, when ether is available, for the production of anæsthesia, can hardly be justified, especially if a fatal result follow its administration.

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Local Anæsthesia.—The diminution of the cutaneous sensibility, by the application of ice and freezing mixtures, has long been practised. It was not, however, until Richardson's method by the hand-ball spray apparatus had been proposed, that there had been much use made of local anæsthesia.

This method consists in directing a current of atomized ether against the part to be anæsthetized. The ether employed for this purpose should have a specific gravity not to exceed 0.723. Rhigolene, the lightest liquid known, a product of the fractional distillation of petroleum, is more effective than ether, but great difficulty attends its use owing to its extreme volatility. When a current of atomized ether or rhigolene is directed against the skin, the rapid evaporation produces an intense degree of cold, in consequence of which the nerves lose their power of transmitting impressions to the sensorium.

A serious drawback to the process of producing local anæsthesia is, the unpleasant burning which follows in the part when it recovers from the freezing, and also the great pain which attends the application of ether-spray to certain parts.

Therapy.—For small operations, such as *extraction of teeth*, and *opening abscesses*, the method of local anæsthesia is extremely useful. It has been, and can be, used with entire success in much larger operations, but it is generally employed for merely minor ones.

The application of ether-spray to the spine is an extremely serviceable remedy in *spinal irritation* and in *chorea*. In the latter disease it alone suffices to effect a cure. In *neuralgia* of superficial nerves, *lumbago*, *muscular rheumatism*, etc., the ether-spray affords relief very quickly, which may be permanent.

Nitrous Oxide.—Protoxide of nitrogen. Laughing-gas.

Composition and Properties.—A colorless, inodorous gas, having a slightly sweetish taste, and a specific gravity of 1.527. It consists of one equivalent each of nitrogen and oxygen. It increases the rate of combustion of inflammable substances. Water at ordinary temperature absorbs about three-fourths of its bulk of the gas. By pressure and cold the gas may be condensed into a liquid, and can then be stored up in suitable vessels for transportation and use. The quantity of the gas taken up by cold water may be much increased by pressure, and the water will then yield it up on heating. Hence this constitutes a convenient mode of storing the gas for preservation. The ordinary mode of storing the gas is in gas-bags, holding about eight gallons, in gasometers, or in the liquid form in strong metallic casks.

Physiological Actions.—The first surgical operation performed with a modern anæsthetic was the extraction of a tooth, the subject being unconscious from the inhalation of nitrous oxide. It had long been known that this gas produced decided exhilaration, when inhaled to a certain point. It has a very short anæsthetic stage, unless the inhalation of the gas be continued.

The first effect of the inhalation of nitrous oxide is a subjective dizziness, whirring noises in the ears, and tingling and loss of sensation throughout the body. Extraordinary illusions beguile the senses, and the intoxicated subject suddenly breaks forth into singing, declamation, sobbing, melancholy, or manifests a pugnacious tendency and assaults those about him. As the effects quickly cease, and as the return to consciousness is very abrupt, the subject is surprised and ashamed to find himself in some ridiculous or *grandiose* position quite foreign to his usual demeanor.

When used to produce anæsthesia for surgical operations, the inhalation of the gas is forced, and the stage of excitement is very brief. The countenance assumes a frightful aspect, most alarming to those who have not witnessed the inhalation of the gas. The face becomes deadly pale, the respirations, at first shallow, soon assume a stertorous character, the jaw becomes fixed, the eyes protrude, and the pallor of the face is presently replaced by a bluish and purplish tint.

So far as the exterior phenomena can afford any indication of the nature of the action, the condition produced by nitrous oxide is an asphyxiated state. The blood ceases to be oxygenated, carbonic acid accumulates, and the centres of conscious impressions are rendered inactive in consequence of the deficient supply of oxygen, and the excess of carbonic acid. The rational indications of the nature of the narcosis produced by nitrous oxide are confirmed by physiological experiment. It has been found that the exhalation of carbonic acid is decidedly diminished by the inhalation of nitrous oxide, and that animals live no longer in an atmosphere of this gas than in an atmosphere of nitrogen.

The inhalation of nitrous oxide appears to be almost free from danger, and it is rare that unpleasant after-effects follow its administration. Two fatal cases have certainly occurred, which can with propriety be attributed to the lethal action of this gas, and various cases have fallen under the observation of the author in which nervousness, vague mental symptoms, and headache, have been experienced after the inhalations.

Therapy.—The very prompt action of nitrous oxide and the quick subsidence of the narcosis render it a very useful anæsthetic agent when small operations, quickly executed, are to be performed. It is especially adapted for the *extraction of teeth*, *opening of abscesses*, and *similar minor operations*. But it has also been used successfully for maintaining prolonged anæsthesia for the *performance of capital operations*. There is no difficulty in keeping up insensibility from fifteen minutes to a half-hour, since the introduction of liquefied gas and of apparatus for its suitable application.

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Chloral.—Hydrate of chloral. *Chloral*, Fr.; *Chloralhydrat*, Ger.

"A white, crystalline mass having a pungent odor and taste, soluble in its own weight of distilled water, and readily soluble in alcohol. When heated it fuses and evaporates without residue, and in the open air without combustion. The aqueous solution is not precipitated by the nitrate of silver, and, when mixed with an equal bulk of nitric acid and heated, no red vapors are evolved. The solution acidulated with sulphuric acid, and faintly tinged with permanganate of potassium, is not decolorized within three hours. The crystals float on sulphuric acid and, when the two are agitated together, the acid becomes temporarily turbid, but remains colorless after being heated."

Dose, grs. v—℈j, or more, but it should not be forgotten that ʒ ss has produced toxic symptoms.

Antagonists and Incompatibles.—The depression of the heart and respiration caused by chloral is antagonized by alcoholic stimulants, ammonia, atropia, by galvanism, and by artificial heat. These are, therefore, appropriate remedies to be employed in cases of poisoning. Strychnia is held by Liebreich to be antagonistic, and hence it may be administered hypodermatically when the measures above mentioned are being used.

Alkalies decompose chloral with the production of formic acid and chloroform, hence all agents having an alkaline reaction are incompatible.

SYNERGISTS.—The hypnotic medicines, notably opium, and the anæsthetics, deepen the effects of chloral when they are simultaneously administered.

PHYSIOLOGICAL ACTIONS.—Chloral has considerable antiseptic property, and is preservative of animal textures. It produces redness and inflammation of the skin, when kept in contact with it for a lengthened period. The taste of chloral is hot and pungent, and it excites an abundant flow of saliva. In the stomach it causes first a cooling sensation, followed by warmth, and when taken in large quantity may set up a high degree of gastric irritation, nausea, and vomiting. In moderate quantity chloral rather stimulates than impairs the appetite, and indigestion and nausea do not, as a rule, follow as an after-effect.

Chloral diffuses into the blood rapidly. The changes which occur after its entrance into the vessels is much disputed. Liebreich, as is well known, was led—by observing the reaction when chloral is brought into the presence of an alkali—to the deduction that the soda of the blood would split up chloral into chloroform and formic acid, and that, therefore, the effects belonging to chloroform might be produced by the administration of chloral. It is probably true that this reaction does take place to some extent, but there are several insuperable objections to the theory of Liebreich:

1. The effects of chloral differ from those produced by a corresponding quantity of chloroform.
2. After the administration of chloral, there is no elimination of chloroform by the breath or urine.
3. Chloral is more decidedly hypnotic, and much less anæsthetic, than chloroform.
4. Crystals of chloral have been recognized in the blood, and the products of the decomposition of chloral have recently been recovered from the urine.

The effects which follow an ordinary medicinal dose (fifteen to thirty grains) are not the same in all subjects, although it must be admitted that a great degree of uniformity exists. When there is present an insusceptibility to its hypnotic action it produces headache, and in some subjects a delirious excitement. Immediately preceding its hypnotic action there is developed in all subjects a stage of excitement, usually very short in duration, and followed by sudden and complete sopor. The sleep produced by chloral is extraordinarily like natural sleep, and is calm, dreamless, and refreshing. It is not a condition of narcotism, and the patient may be easily aroused to take food and nourishment, and will quickly and without difficulty fall asleep again. As a rule no unpleasant after-effects are experienced from a dose of chloral—no headache, faintness, giddiness, nausea, and constipation, so common after morphia. The quantity of chloral necessary to produce sleep, without dangerous narcotism, ranges from fifteen to forty grains, and the duration of the effect varies in different subjects from two to eight hours. Chloral does not destroy the sensibility to pain, unless administered in a quantity sufficient to suspend the functions of the cerebrum. It is not a pain-relieving agent in the sense that morphia is.

When sleep is produced by proper medicinal doses of chloral the pupil contracts a little, the pulse may remain unaltered or become slower, and the respirations are unaffected. When a dangerous or lethal dose is taken, profound narcotism will follow; the respirations will be slower and shallower, the pulse will become weak, rapid, and irregular; sensibility and the reflex movements will be abolished, and complete muscular relaxation will ensue. The mode of dying is by suspension of the functions of the cerebrum, and, finally, by paralysis of the respiratory centre, and of the cardiac motor ganglia. Death may be suddenly produced by paralysis of the heart, in cases of fatty degeneration of the muscular tissue of this organ, without proceeding so far as to involve the lower centres of the brain.

A marked reduction in temperature, notably in rabbits—so much as 8° Fahr.—is produced by chloral, but this effect may be considerably lessened by enveloping the body in non-conductors (Brunton), which act by preventing the cooling of the blood by the atmosphere. The first effect of chloral is to raise the arterial tension (stage of excitement), but this action quickly ceases, and a decided lowering of the tension results. The diminished arterial tension and the weakened action of the heart are the principal factors in the reduction of the body temperature, for the combined action of these agencies is to lessen the combustion process. After death from chloral, congestion of the meninges of the brain and cord, of the lungs, and distention of the right cavities of the heart, have been observed. The arrest of the heart's action takes place in the diastole.

Chloral does not affect the motor nerves nor impair the contractility of muscle; hence the paralytic phenomena both of animal and of organic life produced by it are due to its direct action on the nervous centres.

Very large quantities of chloral have been taken without producing fatal symptoms. I have seen a patient who took daily from two drachms to three drachms of chloral for many months, without any symptoms of acute poisoning. While it is true that enormous doses (several hundred grains) have been taken without producing lethal effects, it is equally true that serious symptoms and death have resulted from very moderate doses (twenty to thirty grains). Great care should therefore be taken in prescribing an agent of such uncertain power. A fatty heart, atheromatous degeneration of the vessels, advanced disease of the lungs, and instability of the nervous system, are contraindications of the use of chloral.

CHLORAL-HABIT.—The habitual use of chloral constitutes a disorder, which, if not as persistent as the opium-habit, has its own difficulties and dangers of no little importance. Those who take chloral habitually have irritable, injected, and rather brilliant eyes, and are voluble in speech, and have a rather excited and hurried manner. They complain usually of singing in the ears, of an empty or vacuous feeling in the brain, and are subject to sudden attacks of vertigo. They are wakeful, and very nervous and excitable, without chloral, when the time for sleep arrives, and they are usually entirely unable to sleep without the usual dose of the hypnotic. During the day they are melancholy, easily fatigued, and their voluntary movements are apt to be uncertain and disordered. The appetite is always capricious, frequently wanting; digestion is labored ; the secretion of bile is deficient, the stools being rather white and pasty ; the urine stained with the bile-elements, and sometimes albuminous.

An increasing weakness and irregularity in the action of the heart; dyspnœa, chiefly when the stomach is distended; redness, injection, and ecchymoses of the skin, have been occasionally observed to occur in cases of the chloral habit.

The best method of managing these unfortunate cases consists in the very gradual diminution of the daily quantity of chloral; in regulation of the diet and administration of a suitable supply of food; air, exercise, and change of scene; chalybeate tonics, with hyoscyamus and lupuline; occasional purgatives.

THERAPY.—Chloral is a remedy of great value in *sea-sickness.* From fifteen to thirty grains every four hours, the recumbent posture for a short time, and suitable nourishment, are the most effective means we now possess for this troublesome disorder. In some cases of *sickness* of *pregnancy* chloral is equally effective, but, like other remedies for this condition, it often fails. According to the author's observation it is most effective when there is much dizziness, faintness, and repugnance to food, and but little vomiting. When the odor of chloral invites nausea, as is not unfrequently the case, it may be given advantageously by enema.

In severe cases of *cholera-morbus*, with cramps, coldness of the surface, cold breath and cold tongue, remarkable relief is procured, and the patient not unfrequently wrested from a condition of extreme danger by the hypodermatic injection of chloral. There is no means of treatment of *cholera* now known so effective as this, as the author has personally witnessed. The effectiveness of chloral is increased by combination with morphia. ℞. Chloral. hydratis, ʒ iij; morphiæ sulph., gr. iv; aquæ laur.-cerasi, ℥ j. M. Sig. *From fifteen to thirty minims—for cholera, cholera-morbus*, etc. This injection produces considerable burning pain and an indurated lump, but in the author's experience suppuration has not followed.

As chloral produces a lowering of the temperature, and, according to Richardson, diminishes the coagulability of the fibrine, good results may be expected from its use in *inflammations and fevers.* It is especially indicated when the temperature is high and there are much delirium and restlessness present. The author has observed excellent results from its use under these circumstances in the *eruptive fevers, pneumonia*, etc. It should not be forgotten, however, that chloral must be prescribed with caution when there is ischæmia of the arterial system—a condition which must necessarily exist when a considerable portion of the lung-space is blocked up by fibrinous or caseous depositions. In *pleuritis, endo-* and *pericarditis*, and in *peritonitis*, much good will result from the use of moderate doses of chloral—five grains every three hours. It is useful because it allays restlessness, causes sleep, lowers the fever, and limits or prevents fibrinous deposits and exudations.

The most important uses of chloral are in diseases of the nervous system. As an *hypnotic*, pure and simple, it is quite unrivaled. Cases of *sleeplessness*, due to mental overwork, anxiety, or physical fatigue, are entirely relieved by fifteen to twenty grains of chloral. The refreshing sleep thus obtained not unfrequently leads to repeated and long-continued use of chloral, and thus the chloral-habit is formed. It follows that sleep should be procured by proper hygienic methods in such cases, if possible, and chloral should be resorted to only after the failure of such means. No hypnotic is so uniformly successful in procuring sleep in *delirium tremens;* but this remedy, as other remedies of the same class, not unfrequently fails. It is more particularly adapted to those cases in which the delirium has succeeded to a debauch, and is less useful, and may, indeed, produce serious symptoms, in old, worn-out drunkards. Violent excitement not unfrequently is produced by it when it fails to cause sleep. The author must caution his younger readers against the too large administration of chloral in this disease. Sleep may be procured which will end in fatal exhaustion. Especially should caution be use in old drunkards, whose heart and vascular system may have undergone serious fatty and calcareous degeneration. In suitable cases there is no doubt chloral is a remedy of the highest value, but it should not be used to the exclusion of suitable hygienic and dietetic treatment.

Various forms of mania, in which delirium and wakefulness are prominent symptoms, are largely benefited by hypnotic doses of chloral. This remark is true of *acute mania, acute melancholia, puerperal* *mania, acute maniacal delirium,* and the excitement which occurs in *general paralysis of the insane.* When it agrees, and produces refreshing sleep, marked improvement in the mental state not unfrequently follows its use. In incurable and intractable cases, chloral often renders the greatest service as a calmative and an hypnotic.

Puerperal convulsions, when the patient is in a condition to swallow, may be arrested by full doses of chloral—twenty grains every two hours. *Infantile convulsions,* when due to reflex irritation, may be suspended by the same means. When the jactitations of *chorea* are so incessant as to prevent sleep, or when they occur during sleep, chloral may be administered with advantage. It is not a curative agent in chorea, but when it produces quiet and refreshing sleep it indirectly contributes to the cure.

Some of the respiratory neuroses are greatly benefited by chloral. The paroxysms of *spasmodic asthma* may be arrested by it, and the *spasmodic attacks of difficult breathing* which accompany *emphysema* may be decidedly ameliorated by timely doses of chloral. It must not be forgotten, however, that the use of chloral is not unattended with danger in pulmonary diseases with ischæmia of the arterial system. In the spasmodic stage of *whooping-cough,* great relief to the paroxysms may be obtained by the use of this agent. From five to ten grains will generally be a suitable quantity for administration in these cases. Impending attacks of *laryngismus stridulus* may be prevented, and seizures already in action can be quickly arrested by a full dose of chloral—five to fifteen grains.

We have no remedy more effective in *tetanus* than chloral, but it must be given in large doses. Nocturnal attacks of *epilepsy* may not unfrequently be prevented by a full dose of chloral at bedtime. In *paralysis agitans,* good effects have been attained by hypnotic doses at bedtime. Chloral is a physiological antagonist to *strychnia,* and may, therefore, be used with advantage in poisoning by this substance.

Chloral is not unfrequently prescribed to relieve *pain,* but under a mistaken notion of its physiological powers. It can only relieve pain by suspending the functions of the cerebrum, and in doses, therefore, which are dangerous. It has no direct pain-relieving power, like morphia. When pain is to be relieved and sleep procured, the combination of chloral and morphia is extremely effective.

Although chloral does not directly suspend the functions of the sensory nerves, it relieves certain kinds of pain due to irregular or overaction of unstriped muscular fibres. Very great relief is afforded by chloral, to the irregular pains of the first stage of labor, which cause suffering but do not advance the case—the so-called "nagging-pains" in popular obstetric language. *Rigidity of the os uteri and soft parts* may be corrected by the timely administration of chloral, and exhaustion may be prevented by giving it in such a way as to suspend irregular uterine action and to procure sleep. *After-pains* are stopped by chloral. In all these cases of obstetric diseases, large doses are generally required.

A solution of chloral is an excellent *antiseptic application to foul wounds:* it destroys the odor of putrefaction, arrests fermentative changes, and promotes the formation of healthy granulations. It may be used to preserve anatomical preparations and morbid specimens. A weak solution of chloral (gr. j to grs. iv—℥ j) is an excellent injection in *gonorrhœa.*

Equal parts of chloral and camphor, triturated together, form a clear fluid, which is often of great service in *neuralgia,* applied to the affected part. It is painted lightly over the surface with a camel's-hair brush, and is allowed to dry on. It is said to allay *spasmodic cough* when painted over the larynx.

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Croton-Chloral Hydrate.—This substance occurs in rather small and brilliant tabular crystals. It is soluble in water, but not freely so; and, as respects antagonists and incompatibles, may be classed with chloral hydrate. Dose, grs. ij—grs. xv, largely diluted in water. It may also be conveniently made into pills with glycerite of tragacanth.

Physiological Actions and Therapy.—Croton-chloral resembles chloral in its hypnotic action, but it is feebler and also less certain. As in lethal doses it causes death by paralysis of respiration, it is admissible in cases of weak heart. It differs from chloral, especially in the singular property which it possesses of causing anæsthesia of the head. Croton-chloral is much less certain in its effects than chloral: sometimes one or two grains will relieve severe trigeminal neuralgia; and often from five to fifteen grains are necessary. When pain is to be relieved and sleep procured, the best results are obtained by a combination of the two agents.

Croton-chloral has proved very effective in various *neuralgiæ*. It been especially useful in *tic-douloureux*, in which it should be given in doses of two to five grains every hour or two, until fifteen grains have been taken. It is probably not safe to exceed this amount at one time. The pains of *dysmenorrhœa* and *sciatica* have also been relieved by the use of this remedy.

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Opium.—Opium. *Opium*, Fr.; *Opium*, Ger. "The concrete juice obtained from the unripe capsules of Papaver somniferum, by incision and spontaneous evaporation.

"Opium, when dried at 212° until it ceases to lose weight, should yield at least ten per cent. of morphia by the officinal process."

Confectio Opii.—Confection of opium. (Opium, aromatic powder, honey.) Dose, thirty-six grains of the confection contain one grain of opium.

Emplastrum Opii.—Plaster of opium. (Extract of opium, Burgundy pitch, and lead-plaster.)

Extractum Opii.—Extract of opium. Dose, gr. ss—grs. ij.

Pilulæ Opii.—Pills of opium. Dose, one to four pills. Each pill contains one grain of opium.

Pilulæ Saponis Compositæ.—Compound pills of soap. (Opium and soap.) Five grains contain one grain of opium.

Pulvis Ipecacuanhæ Compositus.—Compound powder of ipecacuanha. Dover's powder. Ten grains contain one grain each of ipecac. and of opium, and eight grains of sulphate of potash.

Tinctura Opii.—Tincture of opium. Laudanum. Thirteen minims or twenty-five drops are equivalent to one grain of opium.

Tinctura Opii Acetata.—Acetated tincture of opium. Ten minims or twenty drops are about equal to one grain of opium.

Tinctura Opii Camphorata.—Camphorated tincture of opium. Paregoric. Half a fluid ounce contains nearly one grain of opium. Dose, for children, from gtt. v—gtt. xx; for adults, from ʒ j—℥ j.

Tinctura Opii Deodorata.—Deodorized tincture of opium. Dose, m. v—ʒ j.

Vinum Opii.—Wine of opium. (Opium, cinnamon, cloves, sherry wine.) Dose, m. v—ʒ j.

Composition.—About half of the weight of opium is made up of gum, pectine, albumen, and fragments of the poppy-capsules, and calcareous salts. It contains, also, some coloring-matter, and a volatile substance in minute quantity. The proportion of water varies from twelve to thirty per cent. A large number of basic, acid, and neutral substances have been and are still being discovered in opium, hence its chemistry is very complex.

The following natural alkaloids have been found in opium. Various derivatives of these have also been described. This list, except some unimportant modifications, is taken from Flückiger and Hanbury's admirable Pharmacographia:

Hydrocotarnine.—Crystallizable, alkaline. Volatile at 100°. ($C_{12}H_{15}N_1O_3$.)

Morphine (morphia).—Crystallizable, alkaline. ($C_{17}H_{19}N_1O_3$.)

Pseudo-morphine.—Crystallizes with H_2O, does not unite even with acetic acid. ($C_{17}H_{19}N_1O_4$.)

Codeine (codia).—Crystallizable, alkaline, soluble in water. ($C_{18}H_{21}N_1O_3$.)

Thebaine (thebaia).—Crystallizable, alkaline. ($C_{19}H_{21}N_1O_3$.)

Protopine.—Crystallizable, alkaline. ($C_{20}H_{19}N_1O_5$.)

Laudamine.—An alkaloid, which, as well as its salts, forms large crystals. ($C_{20}H_{25}N_1O_4$.)

Codamine.—Crystallizable, alkaline; can be sublimed. ($C_{20}H_{25}N_1O_4$.)

Papaverine (papaverina).—Crystallizable, alkaline. ($C_{21}H_{21}N_1O_4$.)

Rhœadine.—Crystallizable, not distinctly alkaline; can be sublimed. ($C_{21}H_{21}N_1O_6$.)

Meconidine.—Amorphous, alkaline; melts at 58°; not stable; the salts also easily altered. ($C_2H_{23}N_1O_4$.)

Cryptopine (cryptopia).—Crystallizable, alkaline; salts tend to gelatinize; hydrochlorate crystallizes in tufts. ($C_{21}H_{23}N_1O_5$.)

Laudanosine.—Crystallizable, alkaline. ($C_{21}H_{27}N_1O_4$.)

Narcotine (narcotina).—Crystallizable, not alkaline; salts not stable. ($C_{22}H_{23}N_1O_7$.)

Lanthopine.—Microscopic crystals, not alkaline. ($C_{23}H_{25}N_1O_4$.)

Narceine (narceina).—Crystallizable as a hydrate; readily soluble in boiling water or in alkalies. ($C_{23}H_{29}N_1O_9$.)

The only important derivative in the therapeutic sense is *apomorphia*, obtained from morphia by the action of hydrochloric acid. This possesses active emetic property, and will be grouped with emetics.

Besides the foregoing alkaloidal and basic substances, opium contains a peculiar acid (*meconic acid*), and, according to T. and H. Smith, a peculiar form of lactic acid (*thebolactic*).

The proportion of morphia in Turkey opium should not be less than ten per cent., and in good specimens may reach fifteen per cent. Pseudo-morphine occurs in the minute quantity of 0.02 per cent. The proportion of codeine varies from one-fifth to two-fifths per cent. Thebaine and papaverine exist in Turkey opium in about the proportion of one per cent. Narcotine is found in considerable quantity in different varieties of opium, and ranges in amount from one and five-tenths to ten per cent. Narceine varies from 0.1 to 0.71. The quantity of cryptopine and rhœadine is extremely small.

The morphia of opium exists in the drug in the form of the tribasic meconate. The proportion of meconic acid is about three to four per cent. of the crude opium.

The value of opium depends on the quantity of morphine which it contains.

Morphia.—"In colorless crystals, which are inflammable and wholly dissipated by red heat. It is scarcely soluble in cold water, slightly so in boiling water, and freely soluble in boiling alcohol. Nitric acid first reddens it, and then renders it yellow. With a solution of sesquichloride of iron, it assumes a deep-blue color. Its solution restores the color of litmus, previously reddened by an acid."

Morphiæ Acetas.—Acetate of morphia. "A white powder, wholly soluble in water and in alcohol. From its solution potassa throws down a precipitate, which is dissolved by an excess of the alkali. It is affected by heat, nitric acid, and sesquichloride of iron in the same manner as morphia." Dose, gr. ⅙—gr. ss.

Morphiæ Murias.—Muriate of morphia. "In snow-white, feathery crystals, wholly soluble in water and in alcohol." Dose, gr. ⅙—gr. ss.

Morphiæ Sulphas.—Sulphate of morphia. "In snow-white, feathery crystals, which are wholly soluble in water." Dose, gr. ⅙—gr. ss.

Liquor Morphiæ Sulphatis.—Solution of sulphate of morphia. (Morph. sulph., gr. viij; water, ℥ viij.) Dose, ʒj—ʒij.

Trochisi Morphiæ et Ipecacuanhæ.—Troches of morphia and ipecacuanha. (Morphia, ipecac., sugar, oil of gaultheria, mucilage.)

Liquor Morphiæ Bimeconatis.—Solution of the bimeconate of morphia. Same strength as laudanum. Dose, m. x—m. xx.

The other alkaloids of opium are not officinal.

Codiæ Sulphas.—Sulphate of codia. Dose, gr. ¼—gr. j.

Narcotinæ Murias.—Muriate of narcotine. Dose, gr. ij—gr. x. As an antiperiodic.

Antagonists and Incompatibles.—As regards chemical antagonism the alkaline carbonates, lime-water, and the salts of iron, lead, copper, zinc, mercury, and Fowler's solution, are incompatible with the preparations of opium. Notwithstanding this chemical incompatibility the metallic salts are frequently given in conjunction with opium, and the systemic effects of both are produced. Astringent vegetables (tannin) are also incompatible; they limit physiological activity by forming tannate of morphia, which is not readily soluble.

In cases of opium-poisoning, if any portion of the drug remain unabsorbed in the stomach, the most prompt and efficient emetic should be used. Apomorphia should be injected subcutaneously, if the patient is unable to swallow; if conscious, the sulphate of copper may be administered by the stomach. In a case of opium narcosis which resisted ordinary emetics, violent emesis was induced by a solution of bicarbonate of sodium, followed by a solution of tartaric acid. In the absence of other and more active emetics, powdered mustard may be administered—a tablespoonful to a teacupful of warm water. When the opium swallowed is in solution, the stomach-pump should be used if the narcosis is profound. Cold affusion, artificial respiration, when the breathing flags, and faradization of the chest-muscles, are measures of great practical utility. The author has personally witnessed in several cases the excellent effects of faradization, first, in causing such irritation of the surface as to produce reflex excitation of the respiratory centre; and, second, inducing contractions of the respiratory muscles. As a peripheral irritant, faradization is more humane and seemly, and also more efficient than flagellation.

The action of opium is antagonized, at least in a part of the sphere of its influence, by belladonna. These agents are opposed as regards their influence on the intra-cranial circulation, on the pupil, on the respiratory organs, and on the heart. Opium in lethal doses dilates the arterioles and veins; belladonna contracts them, and, by energizing the cardiac movements, substitutes an active for a passive congestion. *It cannot be too strongly insisted on in this connection that belladonna in too great quantity, or too long in action, exhausts the irritability of the unstriped muscular fibre, and thus induces the very state which its administration was intended to relieve.* The state of the pupil, the action of the heart, and the condition of the reflex movements, are the guides to the administration of belladonna in cases of opium narcosis. The smallest quantity of belladonna which will dilate the pupil, raise the tension of the arterial system, deepen the respiration, and reëstablish the reflex excitability, should be used. The author has a strong conviction, arising from some painful personal experience, that *it is a fatal error to attempt to restore a patient in opium narcosis to complete consciousness by repeated doses of belladonna.* The action of these agents combined is to produce profound sopor, and this is not a condition of danger so long as the pulse, respiration, and reflex movements, are in good condition. To substitute belladonna narcosis for opium narcosis is only increasing the hazard under which the patient is.

already struggling. Impatient to afford relief, and assuming that the tendency to sleep must be obviated, the physician too frequently, as the history of many cases plainly shows, repeats the doses of belladonna until its action greatly preponderates, and the irritability of the cardiac ganglia is completely exhausted. The author, therefore, feels himself warranted in repeating that *the utility of belladonna consists in its power to maintain the action of the heart, and the respiration, until elimination has taken place*, and that even coma is of little importance provided the respiration, circulation, and reflex movements, are properly maintained.

The hypodermic injection of atropia is the most efficient and satisfactory method of employing this physiological antagonist. Not more than $\frac{1}{120}$ of a grain of the sulphate should be administered at a dose, and this may be repeated every fifteen minutes (up to three doses) until dilatation of the pupil, increased power of the cardiac movements, deeper respiration, warmth and dryness of the skin, and flushing of the face, are produced. No more can be accomplished by the largest doses, and the results of the antagonism must be awaited. Belladonna continues longer in action than opium. In a succeeding chapter, devoted to the consideration of the combined administration of opium and belladonna, or morphia and atropia, the nature and degree of the antagonism will be more fully elaborated.

Coffee, with its active principle (*caffeine*), is also an antagonist to opium. Good results have undoubtedly been obtained by the free use of black coffee, in milder cases of opium narcosis. The unpleasant confusion of mind, and vertigo, which in so many subjects are experienced after the subsidence of the effects of a medicinal dose, may sometimes be removed by a cup of strong coffee. These cerebral effects may be prevented, or relieved when they occur, by a full dose of bromide of potassium. This discovery, if we may dignify so small a matter by so imposing a title, was briefly announced by the author in the first edition of his work on "Hypodermic Medication," and was afterward more fully set forth in a special memoir by Da Costa, of Philadelphia.

Gubler has shown that some of the cerebral effects of opium are antagonized by quinine. Tartar emetic and digitalis also oppose to some extent the action of this remedy on the intra-cranial circulation.

SYNERGISTS.—The cerebral and hypnotic effects of opium are promoted by alcohol and its derivatives (notably chloral), and, within certain limits, by the mydriatics. Its depressing influence on the heart and respiratory organs is favored by aconite, veratrum viride, lobelia, gelsemium, etc. The sudorific action of opium is increased by ipecacuanha.

PHYSIOLOGICAL ACTIONS.—As opium is a very complex substance, made up of numerous principles which differ remarkably among themselves, it will conduce to a better understanding of its actions to consider, first, opium as a whole, and then follow with some details regarding its individual constituents.

The physiological effects of opium are best studied as respects—1. Small medicinal doses; 2. Full medicinal doses; 3. Lethal doses.

1. The preparations of opium have a disagreeable, bitter, and rather nauseous taste. Dryness of the mouth and fauces, huskiness of voice, and diminution in the sense of taste, occur in a short time after administration of the drug has begun, and continue during the whole period of its influence. To the dryness succeeds a viscid secretion, which contains excrementitious matter having a foul odor. When opium does not produce nausea, the appetite may not be impaired, may be even increased; but the rule is that the desire for food is lessened by opium. The secretion of mucus, and of the special glandular apparatus of the gastro-intestinal mucous membrane, is lessened by opium, and hence the digestion and the peristaltic movements are less active. The excretions being thus locked up, dullness and hebetude are experienced, the skin looks muddy, the tongue is coated, and the breath is offensive. When the influence of the opium ceases, it not unfrequently happens that the constipation is succeeded by relaxation of the intestines, and rather profuse and fetid evacuations, and increased urinary discharges, take place.

The action of the heart becomes stronger, and the arterial tension rises. When opium agrees, the sense of fatigue vanishes, and muscular movements become more rapid and easy. The face flushes a little, the pupil contracts slightly, the conjunctivæ may be somewhat injected, and the expression of the eye more brilliant. At this stage the ideas flow more rapidly, but are less sustained and orderly. The appreciation of time, the sequence of events, and the sense of moral fitness, are diminished. The cerebral excitement is, after a period which varies in different individuals, succeeded by calm, by drowsiness, and sleep when it occurs is usually disturbed by visions and dreams, often of a frightful character. In most subjects, after the sopor has passed off, headache, vertigo, confusion of mind, nausea, constipation, and muscular hebetude, are experienced.

2. When full medicinal doses are administered the symptoms above described occur in a more intense degree. The stage of cardiac stimulation and of cerebral excitement is of much shorter duration; and the stage of intoxication and sopor not only comes on more quickly, but is much more pronounced. At first the pulse is increased in frequency and the respiratory movements are more rapid; but the cardiac pulsations soon diminish in number and force, and the respirations become sighing in character and more shallow. There is also present decided dryness of the mouth, fauces, and larynx, and swallowing becomes somewhat difficult and the voice grows husky. Nausea and vomiting, or at least weight and oppression of the epigastrium, ensue. Confusion of ideas, vertigo, somnolence, are succeeded by deep sleep, contracted pu-

pils, slow and relaxed pulse, slow and snoring respirations, a perspiring skin, and, in many persons, an intense general pruritus, which, however, is more harassing at the nasal orifices.

Persons not habituated to the use of opium usually experience, after a full medicinal dose has expended its force, very distressing sequelæ, referable to the cerebro-spinal system. The most important of these after-effects are headache, confusion of mind, vertigo—which is especially severe on assuming the erect posture—nausea, retching and vomiting, complete anorexia, and constipation. A mild but defined hepatogenic jaundice not unfrequently occurs, and the urine is tinged with the coloring-matter of the bile.

3. A lethal dose of opium causes but a transient excitement; the stage of narcosis quickly supervenes, and the functions of animal life are often rather abruptly suspended. The patient soon lapses into a condition of insensibility, with a slow and feeble, or, it may be, rapid and feeble, action of the heart; slow respiration, shallow and quiet or stertorous; face at first flushed, but soon becoming shrunken, pallid, and cyanosed; skin wet; pupils minutely contracted and insensible to stimulation; unconsciousness profound, with muscular relaxation and abolition of reflex movements. This state of opium narcosis is with difficulty distinguished from alcohol narcosis, from cerebral hæmorrhage—especially in the *pons*—and from uræmic coma. An attentive consideration must be given to all available facts in the history of the case, to the surroundings of the patient, and to the odor of the breath or other excretions, for the symptoms of one of the states above mentioned may be represented in another, even to the inequality of the pupils, since a case of opium narcosis has been reported in which such inequality existed.

There are no characteristic structural alterations produced by opium. The brain presents the appearance known as the " wet brain " by pathologists; the subarachnoid spaces and the ventricles contain an abnormal quantity of serum; the intra-cranial veins are engorged, and the *puncta vasculosa* are somewhat more numerous. The right cavities of the heart and the large venous trunks are usually distended with soft coagula. These appearances are largely due to the mode of dying. In consequence of the diminishing frequency of the respiratory movements the blood is imperfectly decarbonized, and the capillary circulation of the lungs is impeded. The action of the heart being weak and the resistance *a fronte* increased, it is obvious that venous stasis must take place.

It is necessary now to consider somewhat more minutely the nature and degree of the action of opium on the different organs and systems of the body. It will save space and avoid repetitions to study these actions in connection with the several principles contained in opium.

THE PHYSIOLOGICAL ACTION OF THE ALKALOIDS OF OPIUM.—1. *Mor-*

phia.—The peculiar powers of opium are represented chiefly in the morphia which it contains. In opium of good quality the proportion of morphia is from ten to fifteen per cent. The actions of the other principles contained in opium differ widely; and as they all possess some activity, the sum of their effects must so far influence the result that the powers of opium and morphia must vary somewhat in kind as well as in degree. One-sixth of a grain of morphia is about equivalent in activity to one grain of average opium.

In general terms, it may be stated that morphia differs from opium in the following respects:

Morphia is less stimulating, less convulsant, and more decidedly hypnotic and anodyne than opium.

Morphia constipates less and affects the contractility of the bladder more than opium.

Morphia has less diaphoretic action and produces much more pruritus than opium.

The physiological action of morphia is best studied as administered subcutaneously. In a short period—from a few seconds to ten minutes—after the insertion of an ordinary dose—one-sixth to one-fourth of a grain—under the skin, the symptoms of morphia narcosis begin. A sense of heat and flushing of the face—after, in most subjects, a very transient pallor—fullness of the head, giddiness, *tinnitus aurium*, and frequently nausea, are experienced. Deep-seated epigastric pain is often felt, and loud borborygmi occur. The vertigo may be so considerable as to render walking uncertain and staggering, or to render the upright position impossible. Injection of the conjunctivæ and contraction of the pupils occur at the same time the cerebral effects are experienced. The lips have a bluish appearance, the mouth and tongue become dry, swallowing is painful, and the voice has a husky tone. When these physiological effects are produced, pain and spasm are relieved, and an indescribable feeling of content takes possession of the mind. A condition of somnolence in many persons, in others of extreme wakefulness, with intense mental activity, is experienced. When sleep occurs it is usually deep but not calm, the respirations are slow, noisy, and labored. Not unfrequently the sleep is disturbed by dreams and visions, or the individual passes into a somnambulistic state, from which he is aroused with difficulty. The action of the heart is diminished in frequency, but a decided rise takes place in the arterial tension. On ophthalmoscopic examination, a marked increase in the vascularity of the retina, and blurring of the papillæ, can be discerned.

Soon after a hypodermatic injection has been practised, itching of the nose, and often of the whole cutaneous surface, is experienced. The skin is at first dry, but, after a time, diaphoresis begins and is sometimes profuse. The relaxation of the skin is coincident with a fall in the arterial tension. The secretions of the mucous surfaces are at first arrested, as well as those of the skin. If the morphia be administered after a full meal, digestion is suspended for a time. The intestinal movements are also arrested for a short period, and constipation is therefore produced; but, very frequently indeed, no change takes place in the time in which the alvine discharges occur, or in their number. Partly in consequence of the increased action of the skin, the quantity of urine discharged is lessened, and, at the same time, difficulty is encountered in its emission. When the desire is felt, an interval of less or greater duration elapses before the flow begins, and, as the contractile power of the bladder and of the ejaculatory muscles is diminished, the discharge is feeble and slow, and the last drops linger in the urethra.

With the decline of morphia narcosis a majority of subjects, probably, experience headache, confusion of mind, anorexia, and nausea.

When a lethal dose of morphia has been administered by any mode, profound narcotism quickly ensues; the pulse becomes slow and feeble, or rapid and feeble; the respirations also become very slow and shallow; the skin cold and sweating; the face pale, cyanosed, and ghastly; the conjunctivæ deeply injected; the pupils minutely contracted, and reflex movements entirely abolished. Respiration ceases before the action of the heart, as a rule, but in some instances very sudden death ensues from paralysis of the heart.

Half a grain is the smallest dose of morphia which has proved fatal to an adult. Five cases, according to Taylor, have been recorded in which one grain of the muriate caused death.

A consideration of the symptoms produced in man by morphia, and the results of experiments on animals, prove that it chiefly affects the cerebro-spinal functions. In the lower animals, the spinal more; in man, the cerebral more than the spinal functions. Morphia first raises and afterward lessens the action of the heart and arteries; first stimulates the pneumogastric end-organs and cardiac motor ganglia, and afterward paralyzes both. It causes death chiefly through paralysis of the muscles of respiration.

2. *Codia.*—According to the author's observations the codia of commerce corresponds closely in action to morphia, but is much feebler. Four grains of codia is about equivalent to one grain of morphia. It has anodyne and hypnotic qualities. Codia produces sleep freer from disturbance, and the after-effects are less disagreeable, than those of morphia. The special direction to the pneumogastric nerve ascribed to it by some observers, seems to the author to exist in nature.

3. *Narcotina.*—This alkaloid is singularly inappropriately named. It has but feeble narcotic power. In children considerable doses produce a calmative effect and drowsiness, but these results are not observed in adults. Experiments on animals have shown that narcotine is a convulsant. While pigeons are poisoned only by two or three

grains of morphia, administered subcutaneously, the same quantity of narcotine causes fatal convulsions. The reverse is true in man. Narcotine is allied in action to berberia, and alkaloids of that group, so far as the effects on man are concerned; and to thebaia, picrotoxine, strychnia, and brucia, so far as the effects on animals are concerned.

4. *Narceine.*—The most contradictory observations have been published on the action of this principle. By Bernard, Béhier, and Eulenburg, it is held to possess remarkable hypnotic power, and to be free from stimulating and convulsant action; by Fronmüller, Harley, Da Costa, Mitchell, and others, it is considered feeble, if not inert. The physiological actions of narceine, therefore, remain *sub judice.* Until further researches are made with chemically pure narceine, and by competent observers, it will be safer to give no opinion on the subject of its actions and uses.

The other alkaloids of opium are curiosities of chemical and physiological research, and may be dismissed in a few words.

Cryptopia is in a much greater degree than narceine an hypnotic and anodyne.

Thebaia has a strong convulsant action in animals.

Various circumstances modify the action of opium. These are chiefly *age*, *sex*, *idiosyncrasy*, *habitual use*, and certain states of the system, as the presence of *pain*, *uræmia*, etc.

The extremes of life are relatively more susceptible to the action of opium, and especially is the susceptibility to its action great in early life. Fatal opium narcosis has ensued in a nursing infant whose mother had taken a medicinal dose. A single drop of laudanum has produced lethal effects in a child under six months of age. Women are more easily affected by opium than men, and they are more apt to be thrown into a condition of hysterical excitement than put to sleep. Nausea, vomiting, headache, and depression, much more frequently occur in women than in men. As a rule, therefore—but to this rule there are, of course, numerous exceptions—women are less favorable subjects for the administration of opium than men.

More than age or sex is the action of opium influenced by idiosyncrasy. There are persons so easily affected by it that the minutest quantity will cause uncontrollable vomiting, faintness, vertigo, and alarming prostration. It is never safe to administer morphia hypodermatically to such subjects, unless in an extremely small dose.

The habitual use of opium diminishes in a remarkable degree the susceptibility to its action. Numerous instances are on record in which a pint or more of laudanum has been taken daily, or several hundred grains of opium, or a scruple of morphia. The author has met with a patient who took a scruple of morphia a day subcutaneously. When opium is given by the stomach, for the relief of a chronic painful disease, to maintain a constant effect increasing doses are necessary. The power of the stomach to absorb opium is doubtless impaired by frequent repetition of the dose, and in consequence of the local action of the drug on the nerves of the stomach. Besides this, the susceptibility of the cerebro-spinal system steadily declines. The proof of these statements is afforded by the action of morphia when used subcutaneously for long periods. A gradual increase of the dose becomes necessary in order to produce a given physiological effect; but the increase is much slower than when it is administered by the stomach.

Great pain lessens the influence of opium upon the centres of conscious impressions. The quantity in grains is of much less importance than the quantity as measured by the physiological reactions. Uræmia, or the retention in the blood of urinary excrementitious matters, is supposed to increase the narcotic influence of opium; but some facts, to be hereafter presented, render it probable that the state of uræmia and the influence of opium on the brain are antagonistic.

THERAPY.—*Stomach pain*, whether simply neuralgic (*gastralgia*), or excited by the presence of food (*irritative dyspepsia*), or due to *ulcer* or *cancer*, is relieved by opium. The preparations of morphia are better than the crude drug, as a rule, in these cases. The endermic application is an excellent mode of procuring relief. The subcutaneous injection, practised in the epigastric region, is still more effective. Morphia is frequently combined with bismuth, or zinc, or silver salts, in painful stomach diseases. ℞. Bismuthi subcarb., *vel* subnitrat., ʒ iij; morphiæ sulph., gr. j—grs. ij; pulv. aromat., ʒ j. M. ft. pulv. no. xij. Sig. *A powder in milk before each meal.* The following formula is also useful, notwithstanding its unchemical relations: ℞. Zinci oxidi, ʒ ss; morphiæ sulph., gr. j—grs. ij. M. ft. pil. no. x. Sig. *One pill, three times a day, before each meal.* A half-grain of the oxide of silver may be substituted for the oxide of zinc in the above formula.

Inflammatory pain, due to corrosive poisons, to *peritonitis*, etc., requires opium. When the stomach is irritable, and the symptoms urgent, the best mode of using the remedy is the hypodermatic injection of morphia. Many kinds of *nausea and vomiting*, stomachal or reflex in origin, are arrested by opium preparations. In vomiting of cerebral origin, or produced by uræmia, or caused by cirrhosis, the use of opium is contraindicated. When vomiting is caused by irritant matters, opium is prescribed after the stomach is emptied. The vomiting which accompanies the passage of *biliary or renal calculi*, *dysmenorrhœa*, etc., is best relieved by opium. Very severe cases of *sea-sickness*, and of the *vomiting of pregnancy*, may be sometimes arrested when all other means fail, by the subcutaneous use of a minute quantity of morphia (one-twelfth to one-sixth of a grain).

Nothing is more common than the prescription of opium in *diarrhœal diseases*, but it is often used without a just appreciation of the conditions requiring it. In *acute diarrhœa*, caused by irritating aliments, such astringent laxatives as rhubarb, or mild salines, should precede the use of opium. When the evacuations are watery, the best results are obtained by a combination of opium with mineral acids, or acetate of lead. In *acute dysentery* opium is a very important remedy, but it is often injudiciously employed. If there be fever, much tenesmus, and the stools consist of mucus and blood, the exhibition of opium should be postponed until salines have emptied the intestinal canal of its contents, and have depleted the distended vessels. An excellent method of administration, especially when the dysenteric inflammation occupies the rectum, is an enema of starch or milk, or a suppository, containing opium in some soluble form. In *chronic dysentery* opium is indispensable. It is usually combined with arsenic, or with the salts of silver, copper, or zinc. In the chronic dysentery of malarial origin, the best results are obtained by a combination of arsenic and opium, according to a formula already given; in that form which succeeds to the acute disease, opium and sulphate of copper, or zinc, or nitrate of silver, or vegetable astringents.

Nothing can be more satisfactory than the treatment of *cholera-morbus* by the hypodermatic injection of morphia. It is always desirable to secure the expulsion of irritating matters before resorting to opiates. For an ordinary case of cholera-morbus from one-twelfth to one-sixth of a grain of morphia suffices. In true *cholera* the utility of opium is most evident in the preliminary diarrhœa, but is entirely without avail in the stage of collapse. Mischief not unfrequently results from its use, for patients emerging from the condition of collapse are either directly narcotized by the opium which had lain unabsorbed in the stomach, or the cerebral symptoms of the secondary fever are greatly intensified by it. In *cholera infantum* opium must be used with caution, if not avoided. The subjects of this malady are easily narcotized, and the nervous system—an unknown morbid state of which bears some close relation to the gastro-intestinal disorder—is rendered so irritable by opium that the symptoms are aggravated by it.

The following formula embodies a truth of great practical importance: ***As a rule, opium does harm in all gastro-intestinal maladies in which there is a deficiency in the proper secretion, or a suspension of the functions, of the liver and kidneys.***

Opium gives a degree and kind of relief in ***hepatic, renal, and saturnine colic,*** which no other remedy or combination of remedies affords. The most prompt and effective form in which the remedy can be administered is the hypodermatic injection of morphia. This relieves the pain, and relaxes the spasm of the affected tube, and at the same time checks the depressing vomiting which attends these cases. The quantity of morphia required will vary from one-fourth to one-half a grain. As the effect is immediate, the most prudent practice consists in the administration of a small quantity (one-sixth to one-eighth of a grain) for the first dose, in order to test the physiological capabilities of the patient, and following this in fifteen minutes with a dose of similar size if the first is well borne and the pain persist.

Opium, in small doses, is a valuable tonic to a *weak and dilated heart.* When administered simultaneously with digitalis, it obviates one of the dangers which may be caused by that agent. In the so-called *passive hæmorrhages*, in which not only is the blood altered in quality but the tension is low, small doses of opium sustain the powers of life, and by increasing the arterial tension lessen the transudation through the vessel-walls. Under these circumstances, the dose of opium should not as a rule exceed five minims of the tinctures, and it should generally be given in combination with ergot, digitalis, tannic and gallic acids, acetate of lead, etc.

The important observation was made by Bernard, and afterward illustrated and confirmed by Nussbaum, that the hypodermatic injection of morphia, administered before the inhalation begins, prolongs the stage of *chloroform narcosis* with a less quantity of the anæsthetic, diminishes the danger of cardiac paralysis, and prevents the after-nausea and depression.

Opium is the most important agent which we possess in the treatment of various *inflammations.* Its efficacy depends upon several factors: it relieves pain, quiets restlessness, and thus removes from the inflammatory process one of its most important elements, viz., an irritable and paretic state of the nerves of the affected part. Besides these effects, opium raises the tonicity of the vessels, helps to maintain the continuity of the blood-current, and hinders the migration of the white corpuscles of the blood. It is especially in inflammations of the serous membranes that its highest utility is manifest, e. g., *pleuritis*, *peritonitis*, *arachnitis.* Good reasons exist for believing that the hypodermatic injection of morphia will sometimes cut short (jugulate) these maladies, if administered just at their outset. If the period for obtaining such a fortunate result has passed, the course and duration of these diseases can be greatly modified by the judicious use of opium. The quantity of opium required will be determined by the effect; the pain should be relieved, the pupils somewhat contracted. A full dose should be administered at the beginning of treatment (two to three grains of opium—a half grain of morphia), and a given physiological effect be maintained by the regular use of smaller doses. Pain is probably the surest guide, for the existence of pain indicates that decided opium narcosis has not been attained.

In *peritonitis*, whether *puerperal*, *traumatic*, or the extension of *intestinal inflammation*, no fact of therapeutics is better established than the curative power of opium. Besides its immediate influence over the inflammatory process, its indirect action, in maintaining the necessary quietude of the intestines, is of the greatest service. In *arachnitis*, *pachymeningitis*, *basilar meningitis*, there are clinical facts which tend to show that small doses of some opiate preparation really accomplish more than any other remedies. The author is convinced that we possess no means of treatment of *cerebro-spinal meningitis* so effective as the opiate treatment. The same rule as to the quantity required, as that given for peritonitis, should be observed: that quantity of opium should be administered which will relieve the pains and rigidity. The best results are obtained by the hypodermatic injection of morphia. When effusion takes place, and stupor and coma ensue, the utility of opium is ended.

In *parenchymatous inflammations*, experience has shown, opium is much less useful. When pain is a prominent symptom, it can be employed to relieve it; in small, stimulant doses, it may be given to maintain the action of the heart. In *pneumonia* opium is a remedy of very doubtful utility. Its narcotic action certainly disposes to pulmonary congestion, although it may be cautiously used to allay pain and moderate cough.

In *fevers*—*typhoid*, *typhus*, and *eruptive fevers*—opium was formerly much more frequently prescribed than at present. The cold baths, antipyretics, and more favorable hygienic influences, have lessened the violence and diminished the mortality from fevers. The maniacal excitement and the low, muttering delirium are not so frequently observed now as formerly, and hence the use of opium in these affections has greatly declined. The discovery of chloral has also diminished the use of opium as an hypnotic. Nevertheless, when there is much restlessness, wakefulness, subsultus, and delirium, opium may render important service. When the delirium is of the low, muttering kind, a small quantity of morphia (one-eighth to one-sixth of a grain) may suffice to procure quiet and refreshing sleep. When the delirium is violent, combination of tartar-emetic with opium, on the plan of Graves, may have a very happy effect. Or opium may be combined with belladonna, or chloral—the former when the condition is one of great depression, the latter when the delirium and wakefulness are excited in character. In *measles* and *scarlet fever*, when there is a condition of profound depression, the eruption being tardy in making its appearance, and is dusky in hue and ill-defined, beneficial results are experienced from the use of opium, especially when combined with camphor.

A threatened paroxysm of *intermittent fever* may be aborted by the hypodermic injection of morphia (one-fourth of a grain). This practice has a high degree of importance in the *pernicious intermittents*, when time is not afforded for an effective use of quinia. The febrile heat of *intermittent and remittent fevers* may be diminished, and the sweating stage induced earlier, by the use of opium in moderate doses (ten minims of the deodorized tincture every two, three, or four hours). The addition of morphia to quinia enables the latter to be better borne by the stomach, counteracts some of its unpleasant effects on the brain, and increases its therapeutical power. When no contraindication to the use of morphia exists, it is good practice to combine it with quinia in the treatment of intermittent and remittent fevers.

Narcotine has decided antiperiodic power, and may be given as a substitute for quinia when reasons exist to prevent the use of the latter. From five to ten grains of pure narcotine may be administered. As an antiperiodic it ranks after arsenic, salicine, and even apiol.

As an *hypnotic* opium is very frequently used in affections of the nervous system. The stimulant properties of crude opium, or its officinal preparations, render it less serviceable than morphia in the group of cases generally requiring an hypnotic. There can be no doubt that remarkable curative results have followed the hypodermatic injection of morphia in *acute mania.* The following are the indications for the use of morphia in mental disorders: prolonged wakefulness, maniacal excitement, persistent refusal of food, drink, or medicine, destructive and suicidal tendencies. As respects individual subjects, the state of the arterial tension furnishes a guide to the use of morphia. If the tension of the arterial system is low a small dose is required. When the pulse is quick, and the arterial tension high, a large dose of morphia, by over-excitation, causes paresis of the sympathetic, and thus reduces action, an indication for the full influence of the agent. Large doses of morphia, when given subcutaneously, require the utmost circumspection in maniacal cases, especially in obese and aged subjects. Besides acute mania, excellent results have followed from the use of morphia in *lypemania* (Krafft-Ebing), in *chronic mania*, and *melancholia.* Probably the best effects have been witnessed from opium in *melancholia.* In this mental disorder, which is a condition of depression, the best form for the administration of opium is the tincture, and the dose required is the stimulant and not the narcotic dose. The author is impelled to add the caution so well expressed in the following words by Maudsley: "It will be well to have in mind that neither opium by the mouth, nor morphia hypodermically injected, will always quench the fury of acute mania, and that successive injections of morphia, followed by brief snatches of fitful sleep, have been followed also by fatal collapse."

It was formerly held that large and increasing doses of opium were necessary for the cure of *delirium tremens*, the theory being entertained that to procure sleep was to insure recovery. It is now known that to reëstablish digestion and to support the powers of life by suitable nutrients are in a large proportion of cases the only means needed to quiet delirium and to cause sleep. Opium, if used at all, must be given cautiously. Chloral has to a large extent taken its place as an hypnotic in this disease, but cases are not unfrequently met with in which morphia agrees better, and is more effective in inducing quiet.

Some cases of *sunstroke*, *coup de soleil*, or "thermic fever," are rapidly cured by the hypodermatic injection of morphia. When the patient is able to swallow, good effects follow the conjoined administration of tincture of opium and brandy. The cases benefited by this treatment are characterized by pallor of the face and weakness of the heart.

Epilepsy and *epileptiform* seizures may be sometimes prevented by the timely administration of morphia hypodermatically. This treatment is best adapted to epilepsy, the attacks of which occur at night, to *petit mal*, and to *convulsive tic.* It is improper in epileptoid seizures, due to tumor or other coarse organic lesion of the brain. In suitable cases, this treatment procures most decided amelioration in the condition of the patient.

The remarkable fact has been demonstrated by Loomis, of New York, that we have in the hypodermatic injection of morphia the most important agent for the cure of *uræmic convulsions, puerperal and non-puerperal.* It is true this mode of treatment had been originally practised by Scanzoni, but Loomis has, more especially, drawn attention to its real power and utility. "The most uniform effect of morphine so administered is, first, to arrest muscular spasms by counteracting the effect of the uræmic poison on the nerve centres; second, to establish profuse diaphoresis; third, to facilitate the action of cathartics and diuretics, especially the diuretic action of digitalis."

In *chorea* Trousseau has carried the administration of morphia to an extraordinary extent. He restricts its use to severe cases, which appear to have a singular insusceptibility to the action of opium even in enormous doses. When the jactitations are incessant, preventing sleep, or persisting in spite of sleep, the utility of morphia is very great. It is most effective when combined with chloral. In these severe cases of chorea, the only limit to the quantity of morphia is the effect produced. It is evident, from the experiences of Trousseau, that very large doses are required, and that curative effects are thus obtained to which small doses are entirely inadequate. The subcutaneous method is more efficient than the stomach administration.

In *tetanus* and *hydrophobia* the use of morphia has been chiefly palliative. M. Demarquay has, however, applied morphia, by deep injection into the tetanized muscles, with greater success than heretofore. He carries the needle deeply into the tetanized muscles, and, if possible, to the point of entrance of the nerves. He injects in this way the masseters, the sterno-cleido mastoid, the neck and sacro-lumbar muscles, etc. The relaxation of the muscles of mastication thus induced permitted the nourishment of the patients. Of three cases thus treated during the siege of Paris two recovered and one died, but the death was due to pyæmia and not to tetanus.

The most important uses of opium, and its various preparations, are in the relief of *pain.* In surgical practice its administration is indispensable to prevent or mitigate *shock*, to quiet *pain*, and to check *in-*

flammation. To particularize on these points would require an epitome of surgery for illustration. Before the administration of chloroform morphia should be injected hypodermatically, to diminish the dangers of the inhalation and to secure relief to the after-pain of the surgical operation. Nothing is more universal in surgical practice than the administration of an opiate after an operation of any magnitude, for the objects above named.

The most signal service is rendered by opium and its preparations in the various *neuralgiæ.* The most effective mode of administration is by subcutaneous injection, and the remedy should be inserted in the neighborhood of the affected nerve, notwithstanding that relief is afforded by the injection at any point. In *tic-douloureux*, *brachialgia*, *cardialgia*, *gastralgia*, *hepatalgia*, *nephralgia*, *sciatica*, and *pelvic neuralgiæ*, immediate relief is afforded by this remedy, and the relief is not temporary and palliative merely, but curative in numerous instances. It appears to be especially curative in *sciatica.* It is a remarkable fact that morphia inserted under the skin, and especially in the neighborhood of affected nerves, exerts a curative power which it does not at all have when administered by the stomach. An efficient method of using morphia in the treatment of neuralgiæ, according to Brown-Séquard, consists in applying it in a finely-divided state to the derma, denuded by a blister. Lafargue proposed the method of inoculation, which consists in inserting morphia into the skin by means of a lancet-puncture. These clumsy and painful processes are by no means equal to the hypodermatic method.

The enchanting sense of relief to suffering wrought by opiates, and especially by the subcutaneous use of morphia, leads to the morphia-habit. It is a singular fact that in these cases the pains which were cured by the remedy return when it is withdrawn, and other painful sensations appear of an even more distressing kind. In practising the hypodermatic method for a long period in severe cases of neuralgia, the utmost care should be used to avoid the morphia-habit.

In the *neuroses of the respiratory organs*, great relief is often afforded by the use of opium in some of its forms. No remedial agent will so quickly cut short a paroxysm of *asthma* as the hypodermatic use of morphia. The paroxysms of difficult breathing, which occur in *emphysema*, are also readily relieved in the same way. But there is great danger of establishing the opium-habit in these chronic cases. In an allied disease—*hay-fever*, *hay-asthma*, or *autumnal catarrh*—the hypodermatic use of morphia is quite as effective as in spasmodic asthma. An *incipient catarrh* may be aborted by a full dose of Dover's powder, taken at the very outset of the inflammation. Morphia and quinia combined are rather more effective than Dover's powder in these cases. Opium, or some of its preparations, enter into the composition of expectorant mixtures to *allay cough.*

The hypodermatic injection of morphia has been shown to possess a high degree of utility in cases of *dilated heart, with difficult breathing*, and *general œdema.* The eighth to the sixth of a grain suffices for this purpose. The effect it has is to quiet and regulate the action of the heart, to allay the distress of breathing, and to permit rest and sleep in the recumbent position. An occasional dose only is necessary (twice or three times a week).

Opium is a very important addition to our resources in the treatment of *diabetes.* It must be given in considerable doses, as Pavy has shown. From six to twelve grains a day are necessary, in order to produce a decided impression. It checks the bulimia—the inordinate appetite—allays thirst, diminishes the flow of urine, and the excretion of sugar, and, probably, arrests or prevents the changes in the nervous system which accompany or are causative of this disease. Although many cases are decidedly ameliorated, it cannot be said that any have been cured by opium.

External Uses of Opium.—A solution of morphia in distilled water is an excellent astringent anodyne in *conjunctivitis*, and, combined with atropia, in *iritis.* ℞. Morphiæ sulph., grs. iv—grs. viij; aquæ destil., ℥j. M. Sig. *A few drops to be put into the eye as necessary.* ℞. Morphiæ sulphatis, grs. iv; zinci sulphatis, grs. ij—grs. viij; *atropiæ sulph.*, gr. j—grs. ij; aquæ destil., ℥j. M. Sig. *Lotion for iritis and other inflammatory affections of the eye.* The last formula, omitting the zinc, is an excellent application in *earache*, the external meatus being filled with it, and in *toothache*, a few drops on cotton being placed in the hollow of the tooth.

Local inflammatory swellings, painful in character, can be relieved somewhat by poultices containing laudanum. Frictions with laudanum are serviceable in *lumbago*, *sciatica*, *myalgia*, and similar superficial painful affections. An infusion of opium (ʒj—Oj), applied hot, is an excellent application to *inflamed joints*, *inflamed testicle*, etc.

On the combined Uses of Opium and Belladonna, Morphia and Atropia.—The conjoined use of these agents is so important a subject from the point of view of practical therapeutics, that the author purposes to consider it under this head. Although a physiological antagonism as respects a part of their action unquestionably exists, it does not extend throughout their whole range of influence in the organism. The balance of actions furthermore produces results which neither is capable of singly. Hence the importance of a more direct presentation of these points than has been heretofore given.

Both act on the brain, atropia causing delirium, hallucinations, and disturbed sleep; morphia producing stupor, somnolence, hebetude of mind. Both relieve pain, but this effect is much greater in the case of morphia. Both produce disorders of motility, staggering, difficulty of coördination of muscular movements, vertigo, confusion of mind, and headache. The reciprocal influence exerted upon each other, when they are administered together, modifies in a remarkable manner their physiological effects.

Morphia corrects the illusions and phantasms produced by atropia. In small doses (e. g., one ninety-sixth of a grain) atropia increases the hypnotic power of morphia, with the result of causing a less disturbed and more nearly normal sleep than is produced by morphia alone. If, however, the quantity of atropia be in excess of what is necessary to establish the physiological balance in the cerebrum, it overrides the action of morphia and asserts its own peculiar power of inducing phantasms, illusions, and hallucinations.

The pain-relieving power of morphia is rather increased than diminished by atropia. The disorders of motility are enhanced by the mutual reactions of the two agents. The after-headache, vertigo, nausea, and depression of the heart's action caused by morphia, are to a large extent prevented by the conjoined administration of atropia. When a large quantity of opium, or morphia, is given by any of the modes of administration, its immediate depressing effects are counteracted by the simultaneous use of belladonna or atropia. Morphia produces contraction of the pupil, and a tetanic condition (according to Graefe) of the muscle of accommodation; atropia causes dilatation of the pupil, and contraction of the ciliary muscle. When used together these effects may be precisely balanced. It requires but a minute quantity of atropia to overcome the action of morphia on the pupil. When these effects on the pupil are balanced, it does not follow that the muscle of accommodation is in a normal condition, for visual defects remain. Morphia prevents the contraction of the arterioles produced by atropia, and, as a necessary consequence, the subsequent relaxation of the muscular fibre.

Morphia depresses the action of the heart, atropia is a powerful cardiac stimulant. Morphia produces pallor of the surface, and reduces the external temperature; atropia causes redness and injection of the skin, and elevation of the body-heat. In some experiments the author ascertained that while atropia alone raised the pulse to 105 from 72, atropia and morphia combined depressed the pulse of the same subject to 60.

Both morphia and atropia produce dryness of the mucous membrane of the mouth and fauces. Morphia suspends, and atropia increases, the peristaltic movements. The sickness and nausea caused by morphia are, to a considerable extent, lessened or prevented by atropia.

Morphia lessens and atropia increases the functional activity of the kidneys; on the skin their effects are opposed, hence when used in combination the urinary secretion is rather increased than diminished by them. Both produce dysuria.

Therapeutical Applications of Opium and Belladonna.—Whenever opium is used to *relieve pain*, to *procure sleep*, to *relax spasm*—

there being no inflammatory action present—belladonna should be combined with it, unless some contraindication should exist to the action of the latter. This formulated expression is more especially applicable to the hypodermatic use of morphia.

In the various *psychical disorders*, in which the general condition is sthenic, opium or morphia should be used alone. When power is deficient, the forces depressed, the temperature rather below than above the normal, belladonna or atropia should be combined with the opium or morphia. For the relief of *insomnia* the combined action of these agents is much more effective than either singly. The proportion in which the alkaloids should be used is about as follows: $\frac{1}{120}$—$\frac{1}{100}$ of a grain of atropia to $\frac{1}{2}$ and $\frac{1}{4}$ of a grain of morphia.

In the *various convulsive disorders* in which opium or morphia may be used, especially hypodermatically, atropia should be combined with it.

The *neuralgiæ* are best treated by morphia and atropia combined, for the following reasons: the combination is more effective, the after-unpleasant effects of either are prevented to a considerable extent.

The *neuroses of the respiratory organs*, of the *abdominal viscera*, etc., are, as a rule, more successfully treated by morphia and atropia in combination, than by either separately.

In *surgical diseases and operations of various kinds*, the combination of morphia and atropia has most important and varied applications, among which may be enumerated: *to render safer and to prolong ether or chloroform narcosis; to prevent or relieve shock; to save suffering; to relax muscles; to facilitate operative procedures.*

The combined administration of morphia and atropia is of the greatest service in obstetric practice: *to relieve the teasing pains of the first stage; to procure sleep in the course of an exhausting labor; to quiet after-pains; to facilitate the performance of various obstetric operations; to arrest puerperal convulsions.*

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Humulus.—Hops. The strobiles of humulus lupulus.

Lupulina.—Lupuline. "The yellow powder separated from the strobiles of H. lupulus." *Lupuline*, Fr.; *Hopfendrüsen*, Ger.

Infusum Humuli.—Infusion of hops (℥ ss—O j). Dose, a teacupful or more.

Tinctura Humuli.—Tincture of hops (℥ v—O ij). Dose, ℥ ss—℥ ij.

Tinctura Lupulinæ.—Tincture of lupuline (℥ ij—O j). Dose, ʒ ss—℥ ss.

Oleoresina Lupulinæ.—Oleo-resin of lupuline. Dose, m. v—ʒ ss or more.

Extractum Lupulinæ Fluidum.—Fluid extract of lupuline. Dose, ʒ ss—ʒ ij.

Composition.—Hops contain *lupuline* (described above), a tannic acid, an essential oil composed in part of *valerol*, *trimethylamine*, and a liquid volatile alkaloid, *lupuline* (?).

Physiological Actions.—Hops is an aromatic stomachic tonic, and as such promotes the appetite and digestive power. It is slightly astringent also. The action of the heart is somewhat increased, the cutaneous circulation excited, and diaphoresis produced.

In a very slight degree, hops first causes cerebral excitement, followed by calm and a disposition to sleep. Experience has shown that it possesses some anaphrodisiac property, and lessens the functional activity of the testes and the apparatus of erection.

Therapy.—As a *stomachic tonic* hops is quite as serviceable as many more rare and costly medicines. It is useful in *atonic dyspepsia*, simple *flatulent colic*, and *mild diarrhœas.*

The power of a hop pillow *to quiet the mind* and to *induce sleep* seems to be well established, but its influence is, doubtless, largely due to imagination and the association of ideas. The tincture of lupuline and the oleoresin are useful remedies in mild cases of *delirium tremens.* They serve a double purpose—as a stomachic tonic and cerebral sedative. A combination of fluid extract or tincture of lupuline and tincture of capsicum is probably the best *substitute for alcoholic stimulants*, when the habit of their use is to be discontinued. ℞. Ext. lupulinæ fluid., tinct. capsici, āā ℥ j. M. Sig. *One or two teaspoonfuls as necessary.* The condition known as *horrors*, or the wakefulness and excitement which just precede the attack of delirium tremens, may often be quite removed by free use of this combination.

Nocturnal seminal losses may be reduced in frequency by the use of lupuline, of which the best preparation for this purpose is the oleoresin. *Chordee* is said to be prevented by the use of lupuline, but the author has been quite disappointed in his attempts to relieve this state by this remedy.

A hop poultice or bag is a domestic remedy for *internal pains* and *inflammation*, especially of the abdominal organs. A quantity of hops is sewed into a muslin bag, dipped in hot water, and then laid over the affected region. It forms a light fomentation, which owes its virtues rather to the heat and moisture than to the anodyne qualities of the hops.

Lactucarium.—Lactucarium. "The concrete juice obtained from lactuca sativa, by incision and spontaneous evaporation." Dose, gr. v—ʒ j.

Syrupus Lactucarii.—Sirup of lactucarium (ʒ j—Oj). Dose, ℥ ss—℥ j.

Composition.—Lactucarium contains several organic substances and eight to ten per cent. of inorganic matter. It yields about fifty-eight per cent. of *lactucerine* or *lactucone*, an inodorous, tasteless neutral substance, a crystallizable bitter principle, *lactucine*, and *lactucic acid.*

Physiological Action, and Therapy.—The soporific quality of lettuce is known to all who eat this vegetable. Notwithstanding this universal experience, careful experiments have shown that lactucarium possesses a very feeble hypnotic quality, if it be not entirely inert. It is only used as a substitute for opium and its alkaloids when these disagree. The sirup of lactucarium is prescribed to relieve cough, but it is more properly employed as a vehicle for more powerful agents of the class of expectorants.

Bromides.—*Ammonii Bromidum.* Bromide of ammonium. *Bromure d'ammonium*, Fr.; *Bromammonium*, Ger. "A white, granular salt, becoming yellow on exposure, readily soluble in water, and sparingly so in alcohol." Dose, gr. v—℈j.

Potassii Bromidum.—Bromide of potassium. *Bromure de potassium*, Fr.; *Bromkalium*, Ger. In white crystals, wholly soluble in water (1 to 1½), but sparingly soluble in alcohol (1 to 13). Dose, gr. v—ʒj.

Sodii Bromidum.—Bromide of sodium (unofficinal). Dose, gr. v—ʒj.

Lithii Bromidum.—Bromide of lithium (unofficinal). Dose, gr. v—℈j.

Calcii Bromidum.—Bromide of calcium (unofficinal). Dose, gr. v—ʒj.

ANTAGONISTS AND INCOMPATIBLES.—Acids, acidulous and metallic salts are incompatible with bromides of ammonium and potassium, and nitrous ether with the former. The physiological actions of the bromides are antagonized by cold, digitalis, belladonna, ergot, and other agents which energize the vaso-motor nervous system.

SYNERGISTS.—Opium, chloral, and remedies belonging to the same group, promote the action of the bromides on the brain; and aconite, veratrum viride, gelsemium, etc., increase the depressing effect of the bromides on the circulatory system.

PHYSIOLOGICAL ACTIONS.—The taste of a bromide is bitter and saline. In a short time after it is swallowed, the characteristic taste returns to the mouth, owing to the outward diffusion of a portion of that administered. The tactile sense of the fauces, as also the muscular movements in the act of swallowing, is diminished by long-continued use of the bromides.

Sixty grains of the bromide of potassium or sodium, and a less quantity of the ammonium salt, will, in some persons produce slight nausea and diarrhœa; in others, a sense of coolness in the epigastric region; but in many, provided the salt is properly diluted, no effect on the stomach. Gastric catarrh is undoubtedly one of the evil results which may follow the protracted administration of the bromides in considerable doses.

These are diffusible substances and hence pass quickly into the blood. When large doses are administered, it is probable that no inconsiderable portion escapes absorption, for they can be detected in the intestinal mucus and in the fæces.

Very obvious effects on the action of the heart, on the respiration, and on the animal temperature, are produced by the bromides if administered in considerable quantity. These functions are depressed, but the depression is much less evident as to temperature, hence, in order to determine this result most careful observations are necessary. The author has ascertained that two drachms of bromide of potassium will lower the temperature in a healthy adult from one-fifth to one-half a degree; the respirations from two to five, and the pulse from ten to twenty beats per minute. These effects are more pronounced in animals, as ascertained by the administration of lethal doses. In man the number of the cardiac pulsations is not only reduced, but their force is diminished, and the tension of the arterial system is lowered.

A transient excitement, intoxication, giddiness, in some persons an anxious mental state, are produced by one or several large doses. As a rule, slight somnolence, and sounder and more refreshing sleep result, provided no disturbing element intervenes. The pupil is not affected in its size and sensibility to luminous impressions, in an adult man by a dose of 120 grains. When long continued the hypnotic effect is much more pronounced, and a constant drowsiness is experienced. The sensibility to pain, but especially the sensibility to tactile impressions, is lowered by the bromides at all accessible points of the mucous membrane, and of the skin—notably of the plantar surfaces of the hand and foot. The diminution of the sensibility of the mucous membranes is in part due to a local action of the salt as it is being eliminated.

Motility is impaired by the long-continued use of the bromides in man, and in animals paralysis of the muscles ensues. If injected into the tissues of a limb, paralysis of motion and sensibility begins in that member. In man the impaired motility is probably due to other factors as well as to the action of the bromides on the muscular tissue, viz., to the cutaneous anæsthesia, and to an anæmia of the coördinating centres in consequence of which their functional power is lowered.

A very notable effect of the bromides—chiefly bromide of potassium—is the diminution of the sexual feeling and of the power of erections produced by it. This fact has been established by abundant clinical evidence. This result is not, however, produced with equal facility in all cases, and considerable doses are necessary in any case.

Prolonged administration of the bromides develops a peculiar state to which the term *bromism* is applied. This condition of chronic poisoning differs from the effects of a few medicinal doses in the extent and intensity, but not in the character, of the symptoms. The following were the symptoms of bromism, as observed in an epileptic boy, to whom two drachms of the bromide of potassium had been administered daily for a month: extreme pallor and anæmia, dilated pupils, acne on face, forehead, and shoulders; a fetid, bromine breath; slow and feeble action of the heart; breathlessness, and quickened pulse on slight exertion; cool hands and feet; a general subjective sense of coldness; movements in walking tremulous and uncertain; diminution of the tactile sensibility of both cutaneous annd mucous surfaces; fauces dry, and the reflex movements sluggish; swallowing somewhat difficult; antaphrodisia and complete relaxation of the genitals; mind weak, manifested in silly conduct and unmeaning laughter.

Various mental symptoms are in some subjects produced by the long-continued use of the bromides. Weakness of mind, without perversion of intellection, is a very constant result of the continued use of large doses. Headache, confusion of mind, and a sort of intoxication, had long ago been observed to follow the use of the bromide of potassium in even moderate doses (Puche). A form of mental derangement, with hallucinations of a melancholic character, has been observed by Hammond and others.

The pallor and anæmia of bromism are due to several causes: to the diminished action of the heart; slowness of the capillary circulation, and consequent interference in the metamorphosis of tissue; derangement of digestion and assimilation in consequence of gastric catarrh; and diminished blood-supply to the cerebro-spinal axis. The disorders of voluntary movement, the uncertain gate, the apparent defects of co-ordination, are variously explained; but, they are doubtless made up of several factors, of which the cutaneous anæsthesia is the most influential. The bromides possess the power to destroy or impair the irritability of the motor and sensory nerves, and the contractility of muscle, and to these effects must be attributed in part the disorders of voluntary movement noted above.

It is very obvious that the bromides depress certain organic functions: they diminish the action of the heart, lower the animal temperature, and lessen the blood-supply to various organs. These results can only be accomplished by a sedative influence on the sympathetic system. Some very accurate observers have maintained that in this action lies all of the physiological power of the bromides (Reynolds, Amory).

Effects of the Bromides compared.—There is a general correspondence in the actions of the different bromides. As respects their influence on the pulse, body-heat, and respiration, the author's comparative experiments have demonstrated that these agents stand to each other in the following order: bromide of sodium, bromide of lithium, bromide of potassium, bromide of ammonium. Very notable differences exist between the bromide of ammonium and the others, due, undoubtedly, to the character of the base.

The author's experiments on animals further demonstrated the following: bromide of potassium possesses the most toxic power, and bromide of sodium the least. The bromide of lithium is first, the bromide of sodium second, and the bromide of potassium third, in hypnotic power. As respects the influence of these agents severally on the reflex faculty of the spinal cord, it may be stated that none of them possess the power to abolish the reflex faculty except when administered in sufficient quantity to produce lethal effects. Considered from this point of view, the bromides may be grouped as follows: bromide of ammonium, bromide of potassium, bromide of lithium, bromide of sodium.

The elimination of the bromides takes place through the mucous membrane of fauces, intestinal canal, and bronchi, through the skin, but chiefly by the kidneys. The rate of elimination varies, but is usually slow, several days being occupied in its diffusion outward from the blood.

THERAPY.—In some kinds of *vomiting* the bromides are most serviceable. The form of vomiting, to the treatment of which they are adapted, is that of cerebral origin; e. g., *the vomiting of cerebral congestion*, *sea-sickness*, *the vomiting of pregnancy*, etc. They are contraindicated in all cases of vomiting due to primary gastric disturbance.

Remarkable improvement not unfrequently results from the use of bromide of potassium in *cholera infantum*. It is difficult to define the precise conditions under which this agent is successful; but, according to the author's observation, it is useless, if not injurious, when defective alimentation is the cause of the attacks, and is serviceable just in proportion to the degree in which an irritable state of the nervous system dominates the gastro-enteric disturbance. When the cause of the attacks is heat, or reflex irritation of the fifth pair as in teething, or cerebral congestion, very excellent results are obtained from the use of the bromide of potassium. ℞. Potassii bromidi, ʒ ij; syrp. simplicis, ℥ ss; aquæ menthæ pip., ℥ jss. M. Sig. *A teaspoonful every hour or two.*

Increased action of the heart (hyperkinesis) due to irritation of the sympathetic, as, for example, such as occurs in exophthalmic goitre, is calmed by the bromides. The irregular and too frequent action of the heart, occurring in hysterical subjects of plethoric constitution, is generally relieved in the same way; but the bromides are contraindicated in all cases dependent on anæmia. Disturbed action (over-action) of the heart, with cerebral hyperæmia, is frequently most advantageously treated by a combination of digitalis and a bromide: ℞. Inf. digitalis, ℥ iv; potassii bromidi, ℥ ss—℥ j. M. Sig. *A tablespoonful morning and evening.*

Da Costa has, in two distinct publications, strongly urged the use of the bromide of ammonium in *acute rheumatism*. Doubtless, other bromides (potassium, sodium, lithium) would be as effective, and are certainly much less disagreeable. The author has used the bromide of lithium with considerable apparent success, in *subacute rheumatism*, in *rheumatic gout*, and to remove the *stiffness* and *nodosities of joints* remaining after attacks of the above-named rheumatic affections. The wakefulness, delirium, and hyperpyrexia, which sometimes complicate rheumatism and gout, are best treated by bromide of lithium, pain being relieved by morphia if necessary.

It has been stated that the bromides, especially bromide of ammonium, diminish the deposition and hasten the retrograde metamorphosis of the fat in *obesity*. Undoubtedly these agents increase waste, but they do so, chiefly, in consequence of a severe gastric catarrh which they set up.

Rabateau has proposed the use of the bromides as eliminating agents in cases of *mercurial*, *cupric*, or *saturnine poisoning*. These agents, more efficiently than the iodides, combine with the deposited minerals, convert them into soluble combinations, and thus cause their elimination. The best results are probably obtained by a combination of the bromide and iodide of potassium.

The most important therapeutical applications of the bromides of potassium, sodium, lithium, etc., are in the treatment of *cerebral disorders from over-action*. The bromides acting on the heart slow its movements, and, on the vaso-motor nerves, diminish the intra-cranial blood-supply. The best results are obtained in the treatment of cases in which there is no anæmia on the one hand, or inflammatory reaction on the other; cases in which the intra-cranial blood-supply is in excess, because the vaso-motor regulating centres are wanting in activity. The most typical representation of this condition is seen in *wakefulness* from cerebral overwork. No clinical fact is more conspicuous than that the bromide of potassium will relieve wakefulness of this kind. The hypnotic action of the bromides is not a certain action like that of chloral, nor like that of morphia under appropriate conditions; considerable mental excitement and an active cerebral congestion may entirely prevent the hypnotic effect. Wakefulness from mental worry, fatigue, unrest of the peripheral nerves (fidgets), and similar causes, will generally be relieved by the bromides. For this purpose a cumulative action is generally desirable, viz., to give a dose of fifteen grains before each meal, and one of thirty grains on retiring. The manner in which the hypnotic action of the bromides is limited by certain states of the intra-cranial circulation is well exhibited in *delirium tremens*. In the condition of nervous excitement and wakefulness which precedes the delirium, and which is known as "horrors," the action of the bromide is most satisfactory; it quiets the restlessness and induces sleep. For this purpose considerable doses are necessary—a drachm every four to six hours. When, however, delirium tremens is fully developed, this remedy is much less efficient, and frequently fails altogether to produce sleep. It is more serviceable in the first than in subsequent attacks of horrors, and its utility diminishes as the structural alterations of chronic alcoholismus increase.

In some cases of *maniacal excitement* the bromides produce excellent effects, but they very frequently fail without apparent reason. In *acute mania* accompanied by heat of head, injected conjunctivæ, and restlessness, refreshing sleep may follow the administration of one full dose; but the remedy fails more frequently than it succeeds. In *puerperal mania* of the sthenic form, with rather quick and full pulse, hot head, and injected conjunctivæ, the author has witnessed excellent results from the use of the bromide of potassium; but it has rather increased the delusions and the depression when the type of the case was melancholic, with systemic weakness and anæmia. A similar experience has been had in the use of the bromides in *hypochondriasis* and *melancholia.* These forms of mental trouble are most usually accompanied by bodily weakness, and are rather increased by the use of the bromides; but it occasionally happens that these agents give an amount of relief afforded by no other drug or combination of drugs. It is impossible to indicate, in the present state of our knowledge, the particular cases in which the bromides may be serviceable, but the author ventures to express the opinion that the state of the intra-cranial circulation, which may be ascertained on ophthalmoscopic examination, will furnish the true guide. It need hardly be observed that the bromides are useless when wakefulness is dependent on pain.

Some kinds of *neuralgia* are much benefited by the bromides. The congestive form of *migraine*, or sick-headache, is generally quickly dispelled by one or more full doses. The form of *migraine* in which it acts almost as a specific is that characterized by a flushed face, throbbing temples, injected conjunctivæ, eyes intolerant of light. The bromides often give great relief in the fugitive nerve-pain of hysterical women; but they are quite ineffectual in neuralgia fixed in a nerve, as, for example, in trigeminal neuralgia, sciatica, etc. The bromide of potassium is often quite successful in *ovarian neuralgia*, and in the nervous unrest which grows out of ungratified sexual instinct in men and women.

Very remarkable results have been obtained by the use of large doses of bromide of potassium in *tetanus.* H. C. Wood gives a tabular statement of fifteen cases which he has collected, in which the bromide of potassium was the chief or the only agent used, and of these but two died. No results equal to this have been achieved by any other agent, not even by Calabar bean. In order to succeed with this remedy it must be given in large doses (ʒj every three or four hours).

Cases of *strychnia-poisoning* have been reported cured by full doses of the bromide of potassium. One case is narrated by Dr. Gillespie in which three grains of strychnia were taken, and the lethal effects were obviated by one ounce of bromide of potassium in divided doses.

No therapeutical fact is better established than the influence of bromide of potassium over *epilepsy* and *epileptiform seizures.* But the curative power of this agent in epilepsy has numerous limitations. It has been well ascertained that bromide of potassium is most valuable in those cases of epilepsy characterized by frequent and violent convulsive seizures. Epileptiform attacks, dependent on the presence of a tumor or other coarse organic lesion of the brain, are usually suspended by the use of this agent, although the neoplasm is unaffected in its growth and development. It is a curious circumstance that attacks, nocturnal exclusively, are less amenable to the bromide-treatment than those which occur in the daytime.

Cases of the *petit mal*, or epileptoid seizures, in which there is temporary loss of consciousness without convulsion, or with a transient spasm of the facial muscles, etc., are as a rule not so much benefited as are cases of the *grand mal*. Hysterical convulsions (hystero-epilepsy) are benefited by the bromide in the degree in which they partake of the nature of true epilepsy. Simple hysterical convulsions are rarely improved even by a course of this medicine. It has been repeatedly shown, as was first observed by Sir Charles Locock, that the bromides are especially efficacious in cases of epilepsy of sexual origin.

Although the bromide of potassium is less effective in the epilepsy of childhood than of adults, it is an excellent remedy in *infantile convulsions* dependent on reflex irritation. After the removal of the irritation the convulsive attacks may continue, but they can be arrested by the use of the bromides. The cerebral congestion which precedes the convulsive seizure may be relieved by this agent, and the threatened attack averted. The author is convinced that the convulsions which attend tubercular meningitis may be prevented by the bromide, but this agent exerts no curative influence in this fatal malady.

In the present state of our knowledge it is not possible to indicate with any degree of certainty, besides the points mentioned above, the kind of cases in which a successful result may be expected from the bromide-treatment. If no improvement be manifest after several weeks of treatment, and if bromism be induced, the case must be regarded as an unfavorable one for this treatment. Brown-Séquard thinks that the cropping out of an "acne-like eruption on the face, neck, shoulders," etc., is an evidence that the bromide is proving curative, and he even asserts that there is "a positive relation between the intensity of the eruption and the efficacy of the remedy against epilepsy." According to Voisin, the abolition of reflex nausea—ascertained by passing a spoon as far back as the epiglottis, without causing attempts at vomiting—is an indication of the successful action of the remedy. Furthermore, he regards the following physiological effects as evidence of curative power: "hypnotic manifestations, general lassitude, an easy and rapid disappearance of reflex nausea, and antaphrodisiac action."

Certain cases of epilepsy, in which the bromide of potassium fails to afford relief, are greatly benefited by strychnia. From this circumstance it has been concluded that the former agent is most serviceable in cases in which a condition of hyperæmia of the brain exists, and that the latter agent produces the best effects when a condition of cerebral anæmia is present.

Various important considerations are connected with the administration of the bromides in epilepsy. The daily dose required varies from half a drachm to four drachms, the limit of the quantity administered being determined by the effect produced. The occurrence of bromism and the arrest of the seizures are the evidences that a sufficient quantity has been introduced into the organism. According to the author's experience, forty grains of the bromide, dissolved in water and given before each meal, or three times a day, and if required a double dose at bedtime, is an amount of the medicine which it is rarely necessary to exceed. When the convulsive attacks have ceased, a single dose of sixty grains at bedtime will generally suffice; but this result must not be interpreted too favorably, and the remedy discontinued, for an immense experience has now demonstrated that security against a return of the attacks can only be attained by a continuance of the remedy for two or more years after all indications of epilepsy have disappeared. After the continuous use nightly of the remedy for a year, the dose may be so far diminished as to give it on alternate nights. Should the attacks recur after temporary cessation, larger doses are required as a rule.

The long-continued use of the bromide of potassium may produce very serious symptoms of bromism. The remedy must then be discontinued, and tonics and restoratives administered until the organism recovers its tone. It is not unfrequently desirable to administer iron during a course of bromides. The author has had excellent results from the following: ℞. Potassii bromidi, ℥ j; ferri bromidi, gr. vj; aquæ, ℥ vj. M. Sig. *A tablespoonful three times a day.* Echeverria has made the observation that taking strong coffee with the meals hinders the development of bromism. The troublesome and very disfiguring acne may be, in part at least, prevented by the conjoined administration of arsenic (three to five drops of liq. potassii arsenitis). Brown-Séquard, with that fondness for complex combinations which he has always exhibited, recommends the following formula for epilepsy: ℞. Potassii bromidi, ℥ j; ammonii bromidi, ʒ ijss; potassii iodidi, ʒ j; potassii bicarb., ℈ij; infus. calumbæ, ℥ vj. M. Sig. *A teaspoonful before each meal, and three teaspoonfuls at bedtime.* There is probably no advantage in this combination, and it is execrable as regards taste. It is true sometimes better results are obtained from a combination of bromides than from the bromide of potassium alone. It is always advisable to combine the iodide of potassium with the bromides, when there is reason to suspect syphilitic cerebral lesions, or when degenerate changes may appear to be taking place.

Vaso-motor disturbances, elsewhere than intra-cranial, are relieved by the bromides. "Such symptoms are, for example, sudden numbness, coldness, deadness, or pricking sensations in one or more limbs; sudden distressing but indefinable feelings in the epigastrium, abdomen, or hypogastrium; or sensations akin to rigor, with much anxiety and palpitation, or 'fluttering,' of the heart. In such cases it may be observed that the local circulation is interfered with; that, for example, the pulse in one arm becomes faltering, irregular in force and rhythm, occasionally intermitting, while that in the other arm may remain unaltered, and the beat of the heart may maintain its normal character."

The *painful flushings of the face, and the sense of fullness in the head*, which occur so frequently at the climacteric period in women, may often be removed by the bromides.

Certain of the *respiratory neuroses* are greatly relieved by the bromides. *Laryngismus stridulus*, when present, may be suspended by the prompt use of full doses, and the tendency to frequent recurrence of the attacks obviated by the steady and continued use of moderate doses of this remedy. It may be combined with chloral: ℞. Potassii bromidi, ʒ ij; chloral. hydratis, ʒ ss; syrp. tolu., ℥ ss; aquæ, ℥ jss. M. Sig. *A teaspoonful every half-hour.* The bromides greatly relieve the spasmodic element of *whooping-cough*, but they do not appear to shorten the duration of the disease. A combination such as given above, for a child of two years, may be prescribed in whooping-cough during the spasmodic stage, and in proportionally larger quantity for older children.

In *spasmodic asthma* very great relief is sometimes afforded by the use of bromides, bût these remedies lose their effect very quickly. The best results are obtained from a combination of the bromide with the iodide of potassium: ℞. Potassii bromidi, ℥ j; potassii iodidi, ℥ ss; aquæ, ℥ iv. M. Sig. *A teaspoonful in sufficient water every half-hour, or hour.*

Cough which is merely reflex (stomachal, intestinal, renal, uterine, ovarian) can usually be cured by the bromides. It is said that a gargle of the bromide of potassium will diminish the cough of phthisis. The author has ascertained that it is only occasionally that such a fortunate result can be achieved in this way. Such a diminution of the sensibility of the fauces can be produced by a few large doses of the bromide of potassium, that this expedient has been proposed to facilitate laryngoscopy and rhinoscopy.

In certain neuroses of the genito-urinary organs, male and female, excellent results have been obtained by the use of the bromide of potassium. *Abnormal sexual excitement* and *nocturnal seminal emissions* may be checked by this remedy. The condition of plethora is the indication for the bromide. When the sexual organs are much relaxed, the erections feeble, and the seminal fluid watery, especially if there be such a constant stillicidium of semen as to constitute the so-called diurnal losses, the bromide of potassium does harm. The more nearly nocturnal seminal losses approach the physiological type, the more effective the bromides. As they act by diminishing the blood-supply to the erectile organs, it is obvious that they are contraindicated when there is debility, and when the erections are feeble. They prove completely successful when the erections are normal as to character, but teasing and persistent. The various nervous disturbances growing out of unsatisfied sexual desire are quieted by these agents. As a rule, *nymphomania* and *satyriasis* dependent on cerebral lesions are not diminished or prevented by the bromides.

Bromide of potassium, in full doses, has been proposed for the relief of *chordee*. The result is generally disappointing, but occasionally relief is experienced from it. Very large doses (ʒ j every four hours) are necessary.

Menorrhagia, dependent on ovarian irritation, is usually promptly arrested by these agents. Sometimes *metrorrhagia*, even when due to a fibroid, is remarkably improved by their use, but success is only occasional, and no precise indications can be laid down.

Various functional nervous disorders associated with, or dependent on, derangements of the sexual system — for example, such as are grouped together under the term *spinal irritation*—are treated with success by the bromides. It is to be noted, however, that a condition of general anæmia or local spinal anæmia, which usually coexists, is a contraindication to the use of these agents. They are useful in proportion to the degree of plethora present.

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AGENTS WHICH DEPRESS THE MOTOR FUNCTIONS OF THE SPINAL CORD AND SYMPATHETIC.

Conium.—Hemlock. *Ciguë*, Fr.; *Schierling*, Ger.

Conii Folia.—The leaves of conium maculatum.

Conii Fructus.—"The full-grown fruit of conium maculatum, gathered while yet green and carefully dried."

Extractum Conii.—Extract of conium. Dose, gr. j—℈j.

Extractum Conii Alcoholicum.—Alcoholic extract of conium. Dose, gr. j—grs. v.

Extractum Conii Fructus Fluidum.—Fluid extract of conium-seed. Dose, m. ij—m. v—m. xl.

Succus Conii.—Juice of conium. Dose, ʒss—℥j.

The preparations of conium are very uncertain in strength. It is pretty well established that the extracts are nearly, if not quite, inert. The best preparations are the fluid extract and the succus.

COMPOSITION.—The special powers of hemlock are due to a peculiar alkaloid (*conia*). This is an oily, limpid liquid, having a strong alkaline reaction, a peculiar odor resembling the urine of mice, and a specific gravity of 0.88. It probably exists in the plant in the form of the malate; but, by some authorities, the acid with which it is combined is supposed to be an acid peculiar to conium, the *coneic acid.* Conia is associated with ammonia, and another crystallizable alkaloid, *conhydrine.*

Conia is quickly decomposed by heat. Exposed to the air it is soon converted into a brownish resin, and becomes inert. Hence it is that the preparations of conium possess but little activity, and are so frequently, indeed entirely, wanting in physiological and therapeutical effects. It is better, therefore, to administer the alkaloid, which, being soluble in alcohol, may be administered in that menstruum, or it may be converted into an acetate and dissolved in a mixture of alcohol-and-water. It is to be noted, also, that different specimens of conia differ remarkably in activity; hence whenever a new preparation is begun, the minimum dose should be first administered until its real power is ascertained (Burman).

Conia.—Dose, gr. $\frac{1}{60}$—gr. $\frac{1}{20}$—gr. $\frac{1}{10}$, or in minim-doses from m. $\frac{1}{10}$

—m. ij. Half a minim of conia (pure) is about equivalent in activity to ℥ j of the best succus conii.

Antagonists and Incompatibles.—The caustic alkalies and tannic acid are chemically incompatible. Physiologically considered, the actions of conium are antagonized by nux-vomica and its alkaloids strychnia and brucia, by picrotoxine, and the tetanizing agents in general.

Synergists.—Gelsemium, tobacco, veratrum viride, aconite, methylstrychnium, hydrocyanic acid, and opium, increase the action of conium.

Physiological Actions.—The preparations of conium possess a considerable degree of acridity, and are therefore apt to produce gastric irritation, nausea, and vomiting. These results sometimes follow the subcutaneous injection of conia. The active principles readily diffuse into the blood. What changes, if any, they induce in the blood are quite unknown. It is probable that they limit the power of the red blood-globules to convey oxygen to the tissues on which they have a selective action—the motor nerves.

When an active dose of conia is administered, weakness of the legs and a sense of weight and fatigue of these members are first experienced. The eyelids become heavy and droop somewhat, and double vision, or confused vision, a feeling of torpor of the mind, and giddiness, follow. Speech is also affected as respects vocal utterance, but the memory for words and the faculties of mind generally are unimpaired. When the dose is a lethal one, paralysis of the voluntary muscles—first of the inferior extremities—ensues, there is considerable vertigo, the mind is torpid and indifferent but not perverted, speech and vision are lost, the respiration becomes labored and slow from paralysis of the respiratory muscles, and death occurs from asphyxia, the action of the heart continuing until after respiration has ceased. The mind remains unclouded to the last, except when delirium ensues from carbonic-acid poisoning. Convulsive movements generally occur in animals from retention of carbonic acid in the blood, and in man sometimes local convulsive movements. Sensation is unaffected until near the close, but a subjective sense of numbness is experienced in the feet and legs, without actual impairment of the functions of the sensory nerves. The body temperature is decidedly lowered, and in a direct ratio to the amount of the paralysis.

The physiological effects of conia, even when produced by decidedly large medicinal doses, are hindered if not entirely prevented by active exercise. When the muscular weakness, the heaviness and sense of fatigue in the legs are first experienced, if resisted and muscular movements are carried on, these sensations disappear, and the whole duration of the physiological effects is much shortened.

The action of conia is, primarily and chiefly, on the end-organs of the motor nerves; the nerve-trunks next lose their excitability, and by an extension of the paralysis the spinal cord is at last involved. The muscular irritability remains unaffected. According to M. Verigo, the paralysis proceeds from the spinal cord, outwardly, to the terminal filaments of the motor nerves. But it is probable that this experimenter operated with a preparation of conia containing methyl-conium, which has been shown, by Crum Brown and Fraser, to affect first the motor columns of the spinal cord.

No constant and characteristic *post-mortem* appearances seem to be produced by conia. The left cavities of the heart are found empty, and the right distended, but these are products of the mode of dying, and are not directly due to the action of the poison. The blood is generally fluid, and the coagula are soft.

Elimination takes place by various channels, chiefly by the kidneys. Conia has been found in considerable quantity in the liver, lungs, and spleen.

THERAPY.—Formerly the preparations of conium were much used for a supposed discutient or resolvent action in *glandular enlargements*, and in certain *kinds of tumors*. But, since it has been shown that the preparation chiefly employed for this purpose (the extract) is practically inert, the supposed cures effected in this way are justly regarded as examples of the *post hoc*. Influenced by the same considerations, conium was supposed to have an alterant and anodyne action in *cancer*. But, since, in the progress of physiological research, it has been shown that conium affects the motor and not the sensory nerves, it is no longer employed to relieve the pains, or to arrest the growth and diffusion, of cancer. It is right to add, however, that able practitioners hold that the discutient and resolvent powers of conium are well established in clinical experience (Stillé).

The true uses of conium are those deduced from a consideration of its physiological actions. As it lowers the functional activity of the motor nervous system, it is indicated in those cases of disease in which motor activity is in excess. Very valuable results have been obtained by the use of *conia* in *mania*, administered with the view of subduing excessive motor excitement. Its real utility consists in quieting muscular agitation, and thus preventing emaciation and maniacal exhaustion. It is considered to be most suitable to the treatment of *acute mania*, without organic brain-lesion (Burman). The dose required for this purpose is m. ss—m. iij, or subcutaneously, commencing with one-tenth of a minim, and gradually increasing it until some characteristic physiological effects are produced.

The succus conii has been used by Harley and others with success in *chorea*. The special object for which it is used in this malady is to quiet the excessive muscular agitation; but, in order to accomplish this result, a sufficient quantity must be administered to produce distinct physiological effects. To quiet muscular agitation is not alone sufficient to cure chorea; a suitable hygiene, proper alimentation, and restorative agents, are indispensable. Some cases of *paralysis agitans* are remarkably benefited by conium (succus), but it is of little avail in cases of *sclerosis*, or when important structural alterations have occurred. Conia is certainly indicated in *tetanus*, *hydrophobia*, and *strychnia-poisoning*, but hitherto it has not succeeded, probably because inert preparations were employed. The author has ascertained that in animals conia rather hastens than retards the lethal effects of strychnia.

In *whooping-cough*, *asthma*, and *laryngismus stridulus*, good effects have been obtained by the use of conium, carried to the point of inducing its characteristic physiological effects. *A priori*, the best results might be expected from the use of conium in *epilepsy*, but it is by no means comparable to the bromides. According to Echeverria, conium is serviceable in those cases of epilepsy "attended by cerebral derangement and vertigo."

The state of *blepharospasm*, which accompanies *strumous ophthalmia*, is relieved by considerable doses of conium. It is necessary in the treatment of this, as of other motor disorders, to give a sufficient quantity of conium to produce sensible physiological effects.

THE HYPODERMATIC USE OF CONIA.—The alkaloid itself is much too irritant for subcutaneous use. The local inflammation which it sets up prevents absorption, and hence the effects are *nil*. The alcoholic solution is almost equally objectionable. The following formula, proposed by Burman, is best adapted to subcutaneous use:

℞. Coniæ, ʒ iij, m. xij.
Acidi acetic. fort., ʒ iij, m. xij.
Spts. vini rect., ʒ j.
Aquæ destillatæ ad ℥ ij.

M. Sig. *Dose, one minim to begin with, and gradually increase as necessary. Five minims of this solution contain one minim of conia.*

"The acid must be added carefully and gradually until neutralization, or as near an approach to it as possible, is attained; litmus-paper being used, from time to time, to determine the reaction." Different specimens of conia may require somewhat different proportions of acid to neutralize it. If the mixture be turbid after the addition of the spirit and water, a little more spirit may be added.

The subcutaneous injection of conia may be practised instead of the stomach administration, in all of the forms of disease for which this remedy is prescribed. By Burman this mode of administration has been practised with much success in the treatment of *acute mania*; by Pletzer, in *asthma*; by Erlenmeyer, in *emphysema* and *angina pectoris*; by Lorent, in *pneumonia* and *pleuritis*; and by Eulenburg, in *blepharospasm*. A marked decrease in the pulse-rate, and in the temperature, has been observed to follow the hypodermatic injection of conia in these diseases. The rational indication for the use of conia in pneumonia and pleuritis is, to give the organs physiological rest by inducing a paretic state of the respiratory muscles.

CONIA AND MORPHIA.—The effects of conia are in every way heightened by morphia. These agents have been very successfully employed in acute mania, conjointly administered subcutaneously. "Conia acting on the purely motor centres, in a sedative manner, and morphia acting in a similar way on the sensori-motor and ideo-motor centres, it follows, as a fair corollary, that the combination of the two, in subcutaneous injection, should lead to effects directly antagonistic to the condition of maniacal excitement; and, such being in fact the case, they may be thus used together with very great success in the treatment of mania." When *nerve-pain* and *muscular spasm* coexist, the best results may be expected from the combined administration of morphia and conia.

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Gelsemium.—Yellow jasmine. "The root of gelsemium sempervirens."

Extractum Gelsemii Fluidum.—Fluid extract of gelsemium. Dose, m. v—m. xx.

The fluid extract is the only officinal preparation. A tincture is prepared by macerating four ounces of the *fresh* root in two pints of diluted alcohol. The dose of this tincture is from ten to thirty drops. The so-called *gelseminine* is obtained by evaporation of the tincture, and is a very uncertain preparation; the dose is gr. ss—gr. ij. It is only used by the eclectic practitioners.

Disappointment is frequently experienced from the use of gelsemium preparations, owing to the fact that they are made from the dried root. In the process of drying, even spontaneously, the alkaloid disappears.

The most trustworthy preparation is the officinal fluid extract, prepared conscientiously from the fresh root.

Composition.—Gelsemium contains a very powerful alkaloid—*gelsemia* or *gelsemina*—in combination with a peculiar acid—*gelsemic* or *gelseminic acid*. It contains also an acrid resin, volatile oil, gallic acid, a yellow coloring-matter, besides some other unimportant ingredients.

Gelsemia.—"In its pure state gelseminine (gelsemia) is a colorless, odorless solid, having an intensely persistent, bitter taste. It has strongly basic properties, completely neutralizing the most powerful acids, forming salts of which the sulphate, nitrate, chloride, and acetate are freely soluble in water." Dose, gr. $\frac{1}{60}$—gr. $\frac{1}{20}$.

Antagonists and Incompatibles.—The caustic alkalies and tannic acid are chemically incompatible. As respects the physiological actions gelsemium is antagonized by the diffusible stimulants, by alcohol, ammonia, belladonna, digitalis, etc. The lethal effects are best treated by emetics, warmth, alcoholic stimulants, by faradization and artificial respiration.

Synergists.—Conium, physostigma, tobacco, opium, etc., when administered with gelsemium, increase its effects in the whole sphere of its physiological activity.

Physiological Actions.—The preparations of gelsemium have a bitter and somewhat aromatic taste, and a narcotic odor. They do not produce gastric irritation. The active substance, being crystalloidal, diffuses into the blood with facility. In moderate doses, but sufficient to produce decided physiological effects, gelsemium causes a feeling of languor and mental calm, slowing of the action of the heart, drooping of the eyelids, dilatation of the pupil, and some feebleness of muscular movements. In larger doses the physiological effects are as follows: vertigo, double vision, amblyopia, paralysis of the levator palpebræ so that the upper eyelid cannot be raised, dilated pupil, labored respiration in consequence of a paretic state of the respiratory muscles, slow and feeble action of the heart, great muscular weakness, and sensibility to pain and touch much reduced. These effects are produced in about a half-hour after the stomach administration, and last two or three hours, when they subside. When lethal doses are taken, the above-described symptoms occur in a more intense degree. The gait is at first staggering, but the power of muscular movement soon ceases, and a sense of numbness diffuses over the body. The eyelids close (paralysis of the levator), the pupils dilate widely, vision is lost, and the pupils cease to respond to the stimulus of light. The lower jaw drops, and the power of speech is lost in consequence of paralysis of the muscles of the tongue. The respirations are labored, shallow, and irregular; the action of the heart weak, feeble, and intermittent. Generally the skin is covered with a profuse perspiration, but no other evacuation takes place. Death occurs from asphyxia, and the action of the heart ceases after the respiratory movements. Consciousness is preserved until near the close, and until carbonic poisoning ensues. In one instance (Wormley) extreme restlessness was noted, but generally there is a condition of calm, a soporose state, or the unconsciousness of carbonic-acid narcosis, and convulsions never occur.

The author's investigations have demonstrated that gelsemium is a paralyzer of motility and sensibility; that sensibility is first affected in cold-blooded animals (frogs), and afterward motility, and that in warm-blooded animals the motility is affected before sensibility. As respects the seat of the action, the author has ascertained that the end-organs of the motor nerves, and the nerve-trunks, do not lose their irritability, and that the muscular contractility is unimpaired. "Its paralyzing effect is due to its action on the motor centre, and not to an action on the peripheral nerve-fibres. It acts also on the sensory portion of the cord, producing at last complete anæsthesia; but this effect in warm-blooded animals, and in man, is toxic only, and follows the paralysis of the motor functions." Applying the precise observations which are made on animals to the explanation of the lethal effects which have occurred in man, we are conducted to the following conclusions: the disorders of voluntary movement, and the more or less complete paralysis of the motor and of the sensory functions, are due to the effects of gelsemium on the motor and sensory portions of the cord, the functions of the sensory columns resisting longer the action of the poison. The labored respiration is due to the paretic state of the respiratory muscles, especially of the diaphragm. The depressed action of the heart is probably secondary to the diminished respiration movements, which produce this result by impeding the flow of blood through the pulmonary capillaries. The dilated pupil, the double vision, the ptosis, are due to paralysis of the third pair.

In rabbits and cats gelsemium, in lethal doses, affects motility in a very remarkable manner: when the paralyzing effects are becoming manifest—first in the fore extremities—these animals perform a series of backward movements, in which sometimes a complete backward somersault occurs. In pigeons, general muscular tremors precede the backward movements. No corresponding acts have taken place in the fatal cases observed in man. A very considerable reduction of temperature occurs from lethal doses in warm-blooded animals.

The author's experimental observations on the physiological actions of gelsemium have since been fully confirmed by Ott and by Ringer, in an elaborate series of investigations. It is to be regretted that the author's experiments are regarded as "inconclusive" by Dr. H. C. Wood.

THERAPY.—Gelsemium is indicated in those maladies in which an exaltation of function has taken place in the motor and sensory spheres of the nervous system. Several cases of *tetanus* have been reported cured by this remedy; but it is impossible to say whether these were examples of *post hoc* or *propter hoc*. *A priori* it might be expected that gelsemium would prove serviceable in this disease, because its action on the spinal cord is opposed to that which takes place in tetanus. In strychnia-poisoning in animals, however, the tetanic spasms are not prevented by the administration of gelsemium. In *mania, with great motor excitement and wakefulness*, this remedy is more useful than conium. To produce the best results from its administration, doses of sufficient strength must be given to produce definite physiological effects, viz., dilated pupil, drooping of the eyelids, and a feeling of languor. In the condition of "horrors" from alcoholic excess, in simple *wakefulness*, in the *insomnia* which results from over-excitement and too great physical activity, cures are not unfrequently obtained by the use of gelsemium. In the *inflammatory affections of the meninges*, and in *cerebro-spinal meningitis, sporadic or epidemic*, with a decided febrile reaction, this agent is extremely useful in small doses (m. v of fluid extract), repeated every two hours so as to maintain a uniform physiological effect.

Gelsemium has been used with success recently in the treatment of *neuralgia of the fifth nerve*. Cases cured by this remedy were, doubtless, not instances of the tic-douloureux, but nerve-pain caused by cold, rheumatism, or temporary excentric irritation. *Intercostal neuralgia*, and especially *myalgia*, is frequently cured by this agent; but considerable doses are necessary—from five to twenty minims of the fluid extract every three hours until the characteristic drooping of the eyelids, dilatation of the pupil, and muscular languor, manifest themselves.

In *convulsive*, or *spasmodic cough*, gelsemium often affords remarkable relief. It is beneficial in the spasmodic stage of *whooping-cough, reflex cough from irritation of the laryngeal nerves, the irritative cough of phthisis with scanty expectoration*, and the *nervous cough* of hysterical subjects. In some cases of *spasmodic asthma* great relief is afforded by gelsemium, but, as is the case with all other remedies for asthma, it frequently fails and loses its good influence even in those cases in which it was at first successful.

The author has witnessed excellent results from the use of gelsemium in *acute inflammations of the lungs and pleura*. In *pneumonia* it affords rest by diminishing the activity of the respiratory function; it allays cough, and, by depressing the cardiac movements, it lessens stasis of the pulmonary capillaries and lowers the temperature. It is better to give medium doses (m. v—m. x of the fluid extract), every two hours, to maintain a constant effect within the limits of safety. It favors, when exhibited in this way, the occurrence of an early crisis, and assists in the production of one critical evacuation—the sweat. A similar mode of administration should be pursued in *pleuritis*, in which its use is equally rational and effective.

Very great relief is afforded by the use of gelsemium in certain *pel-*

vic disorders in women. There is no more generally-useful medicine in *ovarian neuralgia.* The pains of *dysmenorrhœa* are also greatly alleviated by it. The evidence is conclusive that this remedy also suspends *after-pains*, and it is held by some good observers that it quiets the "nagging" pains of the first stage of labor. In these disorders of the female sexual organs, it is generally necessary to administer a quantity of the remedy sufficient to produce some of its characteristic physiological effects.

The first empirical use of gelsemium was in the treatment of the *remittent*, or so-called *bilious fevers* of the South. A considerable number of facts have been accumulated, which show that this remedy exercises a really beneficial influence in *remittent* and *typo-malarial fevers.* It is not an action of specificity—like quinia in *intermittent* and *remittent fevers.* Its power to depress the temperature is probably the real explanation of its utility.

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Arnica.—Arnica. "The flowers of arnica montana." *Racine d'arnica*, Fr.; *Arnicawurzel*, Ger.

Tinctura Arnicæ.—Tincture of arnica. Dose, m. x— ʒ ss.

COMPOSITION.—The chemistry of arnica has not as yet been thoroughly elucidated. Walz has isolated a principle (*arnicine*). The root contains an *essential oil* on which depends, in great part, its physiological activity. The oil is a complex substance. One of its most important constituents is *trimethylamine.*

ANTAGONISTS AND INCOMPATIBLES.—The actions of arnica are antagonized by ammonia, alcoholic stimulants, opium, camphor, etc.

SYNERGISTS.—Aconite, veratrum viride, digitalis, and arterial sedatives generally, increase the effects of arnica.

PHYSIOLOGICAL ACTIONS.—Arnica excites considerable irritation of the skin, if the contact be sufficiently prolonged. It produces when swallowed a sense of heat and acridity in the fauces, and increases the flow of saliva. It is decidedly irritant to the stomach, and causes in large doses nausea and vomiting, and choleraic diarrhœa. Its active principles diffuse into the blood. In small medicinal doses arnica increases the action of the heart and arteries, and excites the functions of the skin and kidneys. In large doses, probably after a short stage of excitement, depression of the circulation, of the respiration, and of the animal temperature, ensues; violent headache is experienced, the pupils are dilated, and paresis of the muscular system comes on. In toxic doses arnica paralyzes the nervous system of animal and organic life, and death ensues in a condition of collapse.

THERAPY.—In *febrile diseases* and *inflammations*, when there is sthenic reaction, arnica in full doses depresses the action of the heart and lowers the arterial tension. It is, therefore, *antipyretic*. For the production of this effect, an infusion is probably a better preparation than the tincture. When, however, in febrile diseases there is present the condition of asthenia, small doses of the tincture (five minims) are to be preferred. That this remedy will produce different results, in small or large doses, need not occasion surprise. It is conceded on all sides that the effects of opium differ according to the size of the dose, and the frequency with which it is repeated.

Good results have been obtained from the use of arnica infusion in *mania* and *melancholia*. The tincture of arnica is exceptionally serviceable in *delirium tremens*, with depression.

In *rheumatism* and *rheumatic gout*, very decided curative effects have been obtained from arnica. The fact that it contains *trimethylamine* is probably the true explanation of its utility in these affections.

The tincture of arnica has a popular reputation for the relief of *sprains*, *bruises*, and external inflammations. The author has known violent erysipelatous inflammation to follow its application to a sprained ankle. It is extremely doubtful whether the good effects are more decided than those of a spirit-lotion. The infusion or decoction does not, it is said, cause local irritation.

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Trimethylamine.—(Unofficinal.) This is an ammoniacal substance, having a strong, fishy odor. It is isomeric with *propylamine*, which is also an ammonia. As the propylamine of commerce is a mixture of various substances, and is of uncertain composition, trimethylamine only should be used (Spencer). The dose of trimethylamine is four to eight minims. Its disagreeable taste may be disguised somewhat by peppermint-water.

PROPERTIES.—Trimethylamine is a colorless liquid, having the composition C_3H_9N. It dissolves freely in ether, alcohol, and water, has a strong alkaline reaction, and is inflammable.

Chloride of Trimethylamine is a stable salt which crystallizes in long needles; it is very deliquescent, and its solution when concentrated has a caustic action on the skin and mucous membrane. It is free from odor, except when heated or mixed with an alkali, when the fishy smell is evolved. The taste of a solution of this salt is alkaline, but not disagreeable (Dujardin-Beaumetz). Dose, grs. ij every three hours.

ANTAGONISTS AND INCOMPATIBLES.—Chemically trimethylamine is incompatible with the mineral acids, the salts of the metals, the alkalies (chlorides), and vegetable infusions. It should always be prescribed alone, in solution, in some aromatic water. Therapeutically it is antagonized by the stimulants, opium, belladonna, digitalis, etc.

SYNERGISTS.—All agents depressing the vascular system and the temperature are synergistic.

PHYSIOLOGICAL ACTIONS.—Applied to the skin, mucous membrane, or areolar tissue, trimethylamine produces decided caustic effects, comparable to those which result from the action of ammonia. It excites gastric pain when taken into the stomach in considerable doses, and will, doubtless, cause a high degree of inflammation if incautiously administered. The most characteristic effects are the lowering of the action of the heart, the depression of the temperature, and the diminution in the amount of urea excreted. In the physiological state Dujardin-Beaumetz found, in some experiments on himself, that the chloride of trimethylamine lessened the temperature and the pulse, but these results were much more decided when it was administered in cases of acute rheumatism. The influence which this agent has on the excretion of urea is still more remarkable. The observations of Dujardin-Beaumetz show that a gradual but considerable decline in the excretion of urea is a constant result of its administration. On the other hand, Spencer says that the excretion of urea is sometimes increased, and, in one case in which the urinary discharge was carefully studied, the urine was almost trebled, and the urea more than doubled, by the use of this remedy. If the diminution of the amount of urea were a constant result, as claimed by Dujardin-Beaumetz, the influence which trimethylamine has on the body temperature might be due to an interference with the combustion process. But the facts do not as yet justify the construction of a theory as to its mode of action.

THERAPY.—Thus far almost the only application made of trimethylamine is in the treatment of *acute rheumatism* and *gout*. In some cases it appears to produce almost complete relief after the administration of a few doses, but generally a longer time is required (Awenarius, Dujardin-Beaumetz, Spencer, Leo). It moderates, at once, the fever and the joint-pain, and very decidedly shortens the duration of the disease. It is said to diminish the tendency to cardiac complication.

This agent, having so decided an influence on the pulse, temperature, and excretion of urea, will, in the future, doubtless be applied to the treatment of other maladies.

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Spencer, Dr. W. H. *On the Employment of Trimethylamine in Rheumatism and Gout. The Practitioner*, February and March, 1875.

Jaborandi.—(Unofficinal.) A plant belonging to the family of rutaceæ—pilocarpus pinnatus (Gubler).

Infusum Jaborandi.—Infusion of jaborandi (℥ ij—Oj). Dose, ℥ ss—℥ ij.

Extractum Jaborandi Fluidum.—Fluid extract of jaborandi. Dose, ʒ ss—ʒ ij.

Tinctura Jaborandi.—Tincture of jaborandi (℥ iv—Oj). Dose, ʒ ss—ʒ ij.

Pilocarpine, Nitrate.—Dose, gr. $\frac{1}{30}$—gr. $\frac{1}{8}$.

Composition.—The important constituent is the alkaloid—*pilocarpine*—which possesses the physiological properties of the drug. It combines with acids to form salts. The salts of pilocarpine crystallize in the oblique system, and are soluble in water. Probably the most eligible preparation is the nitrate. It may be administered hypodermically.

Antagonists and Incompatibles.—The caustic alkalies, the persalts of iron, and the salts of the metals generally, are chemically incompatible. A remarkable antagonism has been shown to exist between jaborandi and belladonna (Ringer and Gould).

Synergists.—Aconite, veratrum viride, gelsemium, and remedies which paralyze the vaso-motor nervous system, promote the activity of jaborandi.

Physiological Actions.—The taste of jaborandi is rather hot and pungent. The considerable doses of the crude drug required to produce physiological effects excite nausea and vomiting, especially if taken on an empty stomach. It has been shown, however, in recent experiments, that these results follow the use of the alkaloid; hence it may be concluded that not bulk alone is the cause of the gastric distress, but that it is one of the physiological properties of the drug.

The active principles of jaborandi diffuse readily into the blood. In about ten minutes after the infusion is swallowed, the face, ears, and neck, become deeply flushed. Simultaneously perspiration begins on the skin, an abundant flow of saliva takes place, the nasal and bronchial mucus, and the tears, are increased, and watery diarrhœa may occur. It is said that, when the salivary secretion is greatly increased, that of the skin is relatively less so, and *vice versa* (Féréol), but this is not generally admitted. The quantity of perspiration poured out by the skin is enormous—the sweat runs from the body and soaks the clothes. The quantity of saliva discharged is also very great. Ringer reports that in two of his cases the amount of saliva was respectively twenty-two ounces and twenty-seven ounces.

The action of the heart is increased by jaborandi, but the arterial tension is notably diminished. The rise in the pulse-rate averages 20 beats, and the duration of this effect is about two and a half hours. A very distinct fall of temperature (0.5° to 2° Fahr.) ensues when the sweating begins, and this decline of body-heat is maintained on an average about four and a half hours. According to Robin, a transient rise of temperature precedes the fall, but Ringer and Riegel deny the accuracy of this observation.

The effects of jaborandi on children, according to Ringer, are, singularly enough, much less, for corresponding doses, than on adults, as respects the flushing, the sweating, the salivation, and the temperature.

More or less drowsiness, both in children and adults, follows the profuse sweating, and pallor succeeds to the flushing. Chilliness is experienced with the cessation of the sweating stage. Languor and debility persist for some hours after the completion of the effects. The drowsiness is probably not due to a direct action of the remedy on the cerebrum, but to the greatly-diminished vascular tonus, and to the loss of fluid from the vessels. Vision is generally affected. The pupil is usually contracted, and the power of accommodation is impaired. No characteristic or constant changes in the fundus of the eye have been observed on ophthalmoscopic examination. Locally applied to the eye jaborandi causes "contraction of the pupil, tension of the accommodative apparatus of the eye, with approximation to the nearest and farthest points of vision, and amblyopic impairment of vision from diminished sensibility of the retina." The eye resumes its normal state in about an hour and a half (Tweedy).

The results of experiment indicate that the action of jaborandi is paralyzant of the vaso-motor nervous system. The flushing of the skin is doubtless due to dilatation of the arterioles, and the increased action of the heart must be referred to the same cause. The sphygmograph demonstrates the lowering of the vascular tension. The decline in temperature must be referred chiefly to the profuse transpiration, but the depression of the vascular tonus may also somewhat influence this result. The data do not yet exist for a statement of the mode in which jaborandi excites the salivary and cutaneous secretions. It probably affects the end-organs of the excito-secretory nerves.

Elimination of the active constituents of jaborandi probably takes place through the organs whose functions are so powerfully excited. It is a remarkable circumstance that the amount of urea passing out in the sweat caused by jaborandi is enormously increased over the normal, amounting to from fifteen to seventeen grains. The urine is not increased. Hence it may be concluded that elimination does not take place by the kidneys.

The experiments which have demonstrated the existence of a physiological antagonism between jaborandi and belladonna have thrown much light on the action of the former. When the heart of a frog is arrested in the diastole by jaborandi, it immediately recommences its beat when atropia is subcutaneously injected (Langley). When the superior ganglion of the cervical sympathetic, and the lingual, and the pneumogastric nerve are divided, jaborandi administered causes profuse salivary secretion; but this action is at once antagonized, and the secretion arrested by the injection of atropia. These agents, therefore, are exactly opposed as respects their action on the nerve-endings in the salivary glands (Carville). The effects of one grain of atropia, in a boy poisoned by it, were, as respects the state of the mouth and skin, antagonized by thirty grains of jaborandi. In three men the perspiration and salivation, caused by sixty grains of jaborandi, were arrested by the subcutaneous injection of $\frac{1}{100}$ of a grain of atropia (Ringer and Gould).

THERAPY.—As jaborandi is a drug of very remarkable powers, it will probably be applied to important uses. Clinical experience is not yet sufficient to enable the author to define the particular conditions for the relief of which this remedy may be prescribed. Nevertheless some important observations have been published. Good results have been obtained from the use of jaborandi in *dropsy*, *ascites*, and *hydrothorax* (Gubler). *Uræmia from desquamative nephritis*, or *chronic parenchymatous nephritis*, is a condition in which the most satisfactory relief may be expected from it. An immense increase of the elimination of urea by the skin, it will be remembered, is one of the results of the administration of this remedy. *Subacute rheumatism*, according to Gubler, is "most happily modified" by it, and, in *bronchitis with asthma*, it sometimes produces "marvelous results." A rebellious case of *acute ophthalmia*, in the hands of Dr. Abadie, yielded quickly to jaborandi.

In various *skin-diseases*, characterized by deficiency in the secretion of the sweat-glands, no doubt this remedy will be very serviceable. As an eliminating agent of *mineral poisons*, it may be employed in lieu of baths. It will probably take place as a remedy for *constitutional syphilis*.

Ringer has used jaborandi with success *to increase the secretion of milk*. As the milk-glands correspond in structure to the sudoriparous glands, and are merely differentiated and specialized for their particular office, the effects of this drug in increasing the production of milk might have been, *a priori*, expected. The author has used recently a fluid extract of jaborandi successfully in a case of deficiency in the secretion of the milk of a nursing-woman.

In two cases of that very intractable disorder *diabetes insipidus*, or polydipsia, Laycock has used jaborandi with the effect to reduce the quantity of urine in one case from three hundred ounces to one hundred and twenty ounces per diem, and, in the other, from one hundred and fifty-eight ounces to ninety-eight ounces per diem.

In the travels of Dr. Piso (about 1640) it is stated that he "saw divers, as it were, in an instant redeemed from death—from the eating of venomous mushrooms, and other unwholesome things—only by drinking a recent infusion of the root of jaborand" (Easby, in the *Lancet*, March 13, 1875).

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Physostigma.—Calabar bean. The seed of physostigma venenosum. *Fève de Calabar*, Fr.; *Kalabarbohne*, Ger.

Extractum Physostigmatis.—Extract of Calabar bean. Dose, gr. ⅙—gr. ss—gr. v.

Tinctura Physostigmatis.—Tincture of physostigma (unofficinal). Dose, m. v—m. xx.

Composition.—Calabar bean contains two alkaloids, *physostigmine* and *eserine*. These have been supposed to be the same, but they differ in important particulars. Physostigmine has an alkaline reaction, is amorphous, colorless, and tasteless. Eserine crystallizes in colorless, rhomboidal plates, and has a bitter taste. Eserine has strong basic properties, and combines with acids to form salts, which are freely soluble. The Calabar bean contains, besides these alkaloids, the ordinary constituents of the common bean, viz., albuminous matters, starch, and oil.

Antagonists and Incompatibles.—The vegetable astringents, tannic acid, and the caustic alkalies, are chemically incompatible. As respects physiological actions, physostigma is antagonized in a limited part, but not in the whole of its actions, by atropia, and still more by chloral. Therapeutically, the tetanizing agents may be regarded as opposed to physostigma.

SYNERGISTS.—The paralyzers, or depressors of the motor nervous system, conium, gelsemium, nitrate of amyl, etc., act in harmony with physostigma, increasing its effects in the whole range of its physiological influence.

PHYSIOLOGICAL ACTIONS.—The preparations of physostigma are apt to excite nausea. Increased secretion of the gastro-intestinal mucous membrane, and increased peristalsis, follow their administration. The active principles quickly diffuse into the blood. Physostigma does not impair the respiratory function of the blood, but, after death, loose coagula are found, the globules have undergone changes of shape, and rectangular plates of hæmato-crystalline occur (Leven and Laborde). The action of the heart is affected by considerable toxic doses; it is paralyzed in the diastole, and is flabby, but it contracts lazily on electric stimulation. In less than lethal doses the action of the heart is slowed, and the arterial tension is, for a brief period, lowered, but soon rises considerably above the normal. As these effects are not due to an action on the inhibitory apparatus, and follow when the heart is separated from the vaso-motor centre by division of the spinal cord, it is probable that the action consists in a stimulation of the cardiac ganglia, and a subsequent paralyzing action on the cardiac muscles. The same result may be due to a paralyzing action on the accelerator nerves of the heart (Köhler). The respiration is more powerfully affected than the circulation. When a lethal dose is administered the respiration becomes slower and shallower, and death ensues from 'arrest of the respiratory movements (asphyxia), the heart continuing in action for some time afterward.

Physostigma does not affect the centres of conscious impressions, and consciousness is preserved until the oxygenation of the blood is so far interfered with that carbonic-acid narcosis supervenes. Giddiness, vertigo, and a sense of muscular weakness and fatigue, are produced by considerable doses (Gubler). When a lethal dose is administered to an animal, its muscular system soon grows weak, and complete paralysis soon after ensues. The voluntary muscular system, however, before complete resolution occurs, is agitated by a succession of tremors —temporary tetanic contractions followed by entire relaxation. These muscular tremblings occur, but more feebly after complete paralysis, and persist in a slight degree after death. The muscular contractility is not destroyed, not even impaired by physostigma.

The irritability of the motor nervês is affected, if at all, to a very slight extent, and the sensibility of the sensory nerves is rather heightened. It follows from these facts that the paralyzing effect of physostigma is due to a direct action on the spinal cord.

Attention has not thus far been directed to the influence of physostigma on the pupil. Whether introduced directly into the eye, or taken into the stomach, or thrown under the skin, it contracts the pupil. This is a local and peripheral action, exactly corresponding, as to its seat, to the action of atropia. The end-organs of the sympathetic, or of the motor oculi, and it may be of both, are acted upon. By some it is held that the contraction of the pupil is due to a tetanic state of the circular fibres (Grünhagen, Rogow); by others, to a paralysis of the dilator system (Fraser, Hirschmann). It were probably safer to accept the conclusion that the nerves innervating both sets of fibres are acted on—the motor oculi stimulated (*see* case by T. Wharton Jones, *Practitioner*, vol. iii.), the sympathetic depressed—for we find that tetanic contraction of the muscular fibre of the intestine, followed by dilatation and a paretic state, can be experimentally produced by physostigma. The apparatus of accommodation is also affected; myosis begins in ten to fifteen minutes after the disks are inserted. Direct galvanization of the iris, contracted by physostigma, causes it to dilate (Engelhardt, Hermann).

THERAPY.—The applications of physostigma to the treatment of disease are by no means so important as the elaborate study given to its physiological action, by various observers, would seem to indicate.

In *torpor of the muscular layer of the intestine, combined with deficient secretion of the mucous membrane*, this agent is often very serviceable. In some subjects fifteen minims of the tincture, or a half-grain of the extract, taken at bedtime, will procure a morning evacuation, but it frequently fails. When the state to be relieved is such as is indicated above, a combination of physostigma, belladonna and nux-vomica is sometimes very effective: ℞. Tinct. physostigmatis, tinct. nucis vomicæ, tinct. belladonnæ, āā ℥ ij. M. Sig. *Thirty drops in water morning and evening.* ℞. Extract. physostigmatis, ext. belladonnæ, ext. nucis vomicæ, āā gr. v. M. ft. pil. no. x. Sig. *One pill at bed-hour.* Physostigma (gr. ¼—gr. ss of the extract) is a useful addition to a cathartic pill. ℞. Ext. physostigmatis, resinæ podophylli, āā grs. iij. M. ft. pil. no. vj. Sig. *One pill at bed-hour.*

To the troublesome *flatulence of women at the climacteric period*, usually associated with a paretic state of the muscular layer of the bowel, very great relief is often afforded by the use of physostigma. With the relief to the flatulence there usually follows relief to the morbid fancies, the headache and vertigo connected with it.

The action of physostigma on the spinal cord, as a paralyzer, naturally suggested its use in *tetanus*. The evidence of its utility is discrepant. Moreover, tetanus, in many instances, manifests a tendency to spontaneous cure. It is difficult, therefore, to estimate the precise value of physostigma, but about one-half of the cases treated with this agent recover—according to Watson ten in eighteen, according to Roemer twenty in forty-seven cases. A larger measure of success might have been achieved, had sufficient attention been paid to the quality of the extract used and to the mode of administration. The following remarks by Dr. Fraser, in regard to the treatment of tetanus by Calabar bean, are of great importance:

"I should myself feel inclined always to commence the treatment by subcutaneous injection, and to repeat such injection until the system is decidedly affected, and then to administer the remedy by the mouth in a dose three times as large as is found necessary by subcutaneous injection. Such a plan might be quite safely followed in a child of even nine years. If the remedial effects continue to be produced by administration by the mouth, it should be persevered with, for such administration has obvious advantages as far as the convenience of the practitioner is concerned. In the more severe cases, however, I believe subcutaneous injection should be alone employed. The distress and increase of spasm caused by swallowing, or the impossibility of introducing substances by the mouth, will render this necessary. I cannot, also, too strongly urge that subcutaneous injection should always be used when severe and continued spasms occur, when a fatal result is imminent from the exhaustion caused by prolonged and frequent convulsions, and when apnœa threatens at once to close the tragic scene. By it we obtain the quickest and most powerful effect.

"From the preceding remarks it cannot be expected that any arbitrary rules of dosage can be laid down. For an adult one grain of the extract by the stomach, or one-third of a grain by subcutaneous injection, will generally be sufficient to commence with. This should be repeated in two hours, when its effects will usually have passed off, and the succeeding doses may be modified according to the experience that will be thus gained. . . . The great object is to produce as quickly as possible, and then to maintain, the physiological effect of physostigma in diminishing reflex excitability. The doses must, therefore, be continued in increasing quantities until this physiological effect is produced, or until the sedative action of the drug on the circulation is carried to a dangerous extreme, or until constant nausea and vomiting compel us to desist."

Influenced by theoretical considerations, physostigma has been prescribed in *chorea* and *epilepsy*, but the results have not been encouraging. It is true successful cases of *chorea* have been reported, but the influence of favorable hygienic surroundings and time is so great in uncomplicated chorea, that we may well doubt whether physostigma has any real influence. Of twelve cases of epilepsy treated by this agent six were improved, and in the other six a notable increase in the number of the epileptic paroxysms took place (Williams).

In *progressive paralysis of the insane* remarkable improvement has occurred under the use of physostigma in a few cases (Browne), but in others the results have been entirely negative (Williams). As in this melancholy disorder no remedies have hitherto been of any avail, it is a gratifying fact that in some cases Calabar bean has seemed to stay its progress.

Since it has been shown that physostigma lessens the activity of the respiratory function, lowers the action of the heart, and depresses the temperature, it has been used in *bronchitis*, *congestion of the lungs*, and *pneumonia*, with a degree of success which warrants more extended and systematic use.

Besides the various applications in ophthalmic practice growing out of the myosis produced by physostigma, it has been used with success in certain *paralytic and convulsive states of the ocular muscles.* In a case of *paralysis of the third nerve*, with ptosis, double vision, and immobile pupil, Wharton Jones effected a cure by the instillation of physostigma into the eye, whence he concludes that the myosis caused by this agent is due to the stimulation of the third nerve. Galezowski recommends the instillation of physostigma into the eye in cases of *suppuration of the cornea*, and in *amblyopia.* Eserine disks (of gelatine) have been successfully employed in *tic.*

The experiments—thirty in number—of the British Medical Association Committee, with regard to the antagonism between physostigma and strychnia, have led them to the following conclusion:

"Although the symptoms produced by either substance were modified considerably by the action of the other, there was no instance of recovery from a fatal dose."

The antagonism between atropia and physostigma, at least to a considerable extent, has been well established, especially by the labors of Fraser. In 1864 Kleinwächter, influenced probably by the marked antagonism of the two agents on the pupil, employed physostigma with success in a case of poisoning by atropia. The British Association Committee, however, conclude as the result of their investigations that—"1. Sulphate of atropia antagonizes to a slight extent the fatal action of extract of Calabar bean; 2. The area of antagonism is more limited than even Dr. Fraser has indicated in his paper on the subject.

Thirty-one experiments, performed by the committee with hydrate of chloral and Calabar bean, have shown that—

"1. Hydrate of chloral modifies to a great extent the action of a fatal dose of extract of Calabar bean, mitigating symptoms and prolonging life.

"2. Hydrate of chloral, in some cases, saves life from a fatal dose of Calabar bean.

"3. If hydrate of chloral be given before extract of Calabar bean, so that the animal is deeply under the influence of hydrate of chloral before it receives the extract of Calabar bean, the symptoms produced by the latter are much modified, and life is saved from the effects of what would otherwise be a fatal dose.

"4. Chloral hydrate is of little service as an antagonist to extract of Calabar bean, if given some time after the latter. If the symptoms of the action of Calabar bean be in full operation it will not save life, however it may modify symptoms."

Note.—It is certainly true that to the singularly meritorious investigations of Fraser ("Transactions of the Royal Society of Edinburgh," vol. xxvi.) we owe the exact knowledge, now in our possession, of this antagonism between physostigma and atropia. Repeating the observation of Gubler and Labée ("Bulletin Général de Thérapeutique," vol. lxxxiv., p. 556), which H. C. Wood ("Therapeutics and Materia Medica," p. 305) has echoed, that "these laborious researches in the special subject with which we are now occupied remain as the model to be followed in all questions of the same class," the author may still be permitted to set forth his own original work in the same field. The following historical points have been fully established:

1864.—The case of Kleinwächter, in which a supposed lethal dose of atropia was successfully overcome by Calabar bean.

1867.—The single experiment of Bourneville, in which the effects of the powdered kernel of physostigma, "introduced into the stomach of a cabiai," were antagonized by atropia administered subcutaneously.

1867.—The investigations of Bartholow were made. Some of the experiments and the results were included in an "Essay on Atropia," which received the prize of the American Medical Association at its annual meeting, May, 1868.

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Tabacum.—Tobacco. *Tabac*, Fr.; *Tabakblätter*, Ger. "The commercial dried leaves of Nicotiana tabacum."

Infusum Tabaci.—Infusion of tobacco (ʒj—Oj). Dose, as an enema, ℥ss — ℥iv.

Oleum Tabaci.—Oil of tobacco.

Unguentum Tabaci.—Tobacco-ointment (℥ ss — ℥ viij).

Vinum Tabaci.—Wine of tobacco (℥ j—Oj). Dose, m. v — ʒ j.

Composition.—Tobacco contains a powerful alkaloid—*Nicotia*, or *Nicotine*—in combination with malic acid. It is an oily, colorless, liquid, strongly alkaline in reaction. Its taste is hot and acrid, and its odor disagreeable and peculiar. It is contained in the dried leaves, in the proportion of about five per cent.

Tobacco also contains a peculiar camphor—*Nicotianine.*

Tobacco-leaves are rich in mineral constituents—potash, lime, nitrates, and phosphates. The vapor of tobacco "contains numerous basic substances of the picolinic series, and cedes to caustic potash, hydrocyanic acid, sulphuretted hydrogen, several volatile fatty acids, phenol, and creosote." (Flückiger and Hanbury, Husemann.) It does not contain nicotia. The oil of tobacco is an empyreumatic product, obtained by distillation.

Antagonists and Incompatibles.—The caustic alkalies, tannin, iodides, are chemically incompatible. Strychnia is, according to Haughton, a true physiological antagonist. Ergot, digitalis, belladonna, ammonia, and alcoholic stimulants, antagonize the effects of tobacco on the heart and arterial system.

In cases of poisoning the stomach should be evacuated by emetics, or the stomach-pump, and tannin and the iodides should be administered. Ammonia and brandy are indicated to relieve the failing circulation. Subcutaneous injection of strychnia should also be resorted to, and, if necessary, artificial respiration.

Synergists.—All of the motor depressants increase the effects of tobacco.

Physiological Effects.—Tobacco is a severe and very depressing nauseant and emetic. It is locally an irritant to the mucous membrane, and produces burning pain at the epigastrium. It is also laxative even when smoked, and in considerable quantity by the stomach causes hypercatharsis. The emetic effect of tobacco is doubtless the product of three factors: its cerebral action, its local irritation of the gastric mucous membrane, and its specific emetic property. The secretions of the intestinal mucous membrane are increased, and the muscular layer is thrown into tetanic contraction, whence the catharsis which follows its administration. Applied to a wounded surface, tobacco produces the same effects.

Its active principle, nicotia, a crystalloidal substance, diffuses into the blood with great rapidity. It corresponds, in the mode and intensity of its action, to prussic acid. In a case narrated by Taylor, a fatal result ensued in three minutes after a toxic dose. In another case, death occurred in five minutes (M. Fougnies, poisoned by Count Bocarmé). When a lethal dose is administered to an animal, the action of the heart continues after respiration has ceased. Its cavities are usually found empty, or containing black fluid blood. Tobacco is not, therefore, a cardiac poison, and the depression of the circulation noted when full medicinal doses are administered are doubtless due to the interference with the pulmonary functions. Applied directly to the muscular tissue of the heart, nicotia does not impair its contractile power (Benham). The blood throughout the body is black and fluid, but as agitation with oxygen restores its color, and as the blood-globules are unaffected, the condition of the blood is doubtless due to the arrest of oxygenation (asphyxia).

Trembling and clonic spasms are produced by lethal doses of tobacco. Its ultimate effect is paralyzing, but preceding the muscular relaxation and paresis there is in animals, and occasionally in man, a definite tetanic stage. Death ensues through its paralyzing action on the muscles of respiration. The end-organs of the motor nerves lose their excitability, next the trunks of the nerves, and then the spinal cord, but the muscular irritability is unaffected. The brain is not directly affected. Giddiness and delirium have been noted in cases of poisoning by tobacco, but these symptoms, as well as the insensibility which immediately precedes death, are no doubt due to the accumulation of carbonic acid in the blood. The pupils are contracted by tobacco, and, in fatal cases, are insensible to light.

There is considerable sweating, and the skin is cold and clammy in fatal cases. The temperature of the body is decidedly reduced (Tscheschichin). The elimination of nicotia probably takes place by the kidneys. Very free urinary discharge, at all events, is produced by tobacco, and, reasoning by analogy, it may be supposed that this effect is due to the direct action of the nicotia on the Malpighian tufts and on the tubules of the kidneys.

When a lethal dose of nicotia has been taken, and the effects follow immediately, there may be none of the symptoms described above. In the case narrated by Taylor, the "deceased stared wildly; there were no convulsions, and he died quietly [in three minutes], heaving a deep sigh in expiring."

THERAPY.—In *habitual constipation*, due to a relaxed state of the muscular layer of the bowel, five minims of the wine of tobacco, administered at bedtime, will not unfrequently afford relief.

Impaction of the cæcum, *colica pictonum*, sometimes *intussusception*, and *strangulated hernia*, may be overcome by a tobacco-enema. It must be borne in mind, however, that this is an expedient not free from danger. Numerous deaths have been caused by it, and Dr. Copeland reports one instance in which thirty grains by enema proved fatal. Of the officinal infusion (℥ j—Oj) it is not safe to use more than four ounces, or fifteen grains; and this quantity may be expected to produce most depressing nausea. It must be urged in favor of this remedy that it has, in very unfavorable cases, proved exceedingly effective. It is especially adapted to cases in which obstruction has occurred from paresis of the muscular layer of the bowel (impacted cæcum, typhlitis, painter's colic).

Tobacco is one of the antispasmodic remedies used in the treatment of *spasmodic asthma*, and the paroxysms of difficult breathing in *emphysema*. It enters as a constituent in various pastilles and cigarettes employed in these maladies. *Asthmatics* unaccustomed to the use of tobacco, are sometimes relieved by smoking a cigar or pipe, but the effect is lost by habitual use. *Laryngismus stridulus* may be quickly arrested by a snuff-plaster to the neck—an effective but dangerous domestic remedy. Obstinate *hiccough*, or *singultus*, may be cured by five-minim doses of wine of tobacco, but we possess other effective remedies, less dangerous and less unpleasant in action.

We possess no remedy more effective in the treatment of *tetanus* than tobacco. It may be used in the form of an enema, commencing with four ounces of the infusion, and regulating the quantity to be administered and the time of administration by the effect produced. Minim-doses of the alkaloid may be given every two hours by the stomach, or two minims by the rectum (Haughton). When it acts favorably it relaxes the trismus so that nutriment may be taken, and suspends the tonic convulsions. Care must be used not to introduce a lethal quantity, and produce death by asphyxia. The author has known the wine of tobacco to be used successfully in a severe case of tetanus, the quantity administered being regulated by the effect of the remedy on the convulsions.

The experiments of Haughton having demonstrated an antagonism between nicotia and strychnia, he proposed the use of nicotia in *strychnia-poisoning*, and cases have occurred in which it proved entirely successful. As the effects of nicotia are so nearly instantaneous, the stomach administration—if the spasms do not prevent—will suffice, but rectal and even hypodermatic injections may be resorted to if necessary. The following formula of Erlenmeyer may be used for the subcutaneous injection in strychnia-poisoning, and in tetanus: ℞. Nicotiæ, gr. ss; aquæ destil., ℨ ij. M. Sig. *Ten minims contain $\frac{1}{24}$ of a grain.* The cases of strychnia-poisoning in which tobacco was used successfully were treated by the infusion.

Tobacco was formerly employed in the treatment of *dropsy.* It is adapted to those cases in which digitalis is now used. It promotes free diuresis, and is at the same time laxative—effects especially serviceable in cardiac dropsy. It is, however, so disagreeable in action that few practitioners have the temerity to prescribe it, and few patients are willing to swallow it.

There is no doubt that excessive use of tobacco lessens the *venereal appetite.* Slightly nauseating doses of the wine of tobacco will check *chordee* and *priapism*. *Satyriasis* is effectively quenched in tobacco-nausea. *Nocturnal pollutions*, due to repletion and to continence, are also usually suspended by the use of this remedy; but it is, unfortunately, so horribly depressing that the remedy may be justly considered the greater evil.

Local Uses of Tobacco.—So many unfortunate accidents have resulted from the external application of tobacco, that its use in this way is rarely justifiable. The infusion and an ointment have been employed with success in *tinea*, *scabies*, *prurigo*, *pityriasis*, etc. An injection of tobacco will destroy *ascarides*, but it is unsafe. Other and more manageable remedies have entirely taken the place of tobacco in the local diseases above named.

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Lobelia.—*Lobelia.* The leaves and tops of lobelia inflata. Indian tobacco. *Lobélie enflée*, Fr.; *Lobeliakraut*, Ger.

Acetum Lobeliæ.—Vinegar of lobelia. (Lobelia, ℥ iv—diluted acetic acid to Oij.) Dose, m. v—ʒ j.

Tinctura Lobeliæ.—Tincture of lobelia. (Lobelia, ℥ iv—Oij of diluted alcohol). Dose, m. v — ʒ j.

Lobelin.—(Unofficinal). A resinoid. Dose, gr. ss—gr. j.

Composition.—The effects of lobelia are due to the presence in it of a peculiar alkaloid—*lobelina.* This principle is oily in consistence, has a pungent, rather acrid taste, a tobacco-like odor, and is strongly alkaline in reaction. It is slightly soluble in water, but more freely soluble in alcohol and ether. It combines with acids to form crystallizable salts, which are soluble in water and in alcohol. The active principle—lobelina—is combined in the plant with *lobelic acid.*

ANTAGONISTS AND INCOMPATIBLES.—The caustic alkalies decompose lobelina; hence these are incompatible. The depressing effects of lobelia on the circulation are counteracted by digitalis, belladonna, ergot, and other vaso-motor excitants, by alcohol, ether, ammonia, etc.; on the nervous system of animal life, by strychnia, picrotoxine, thebaia, etc.

SYNERGISTS.—All of the motor depressants increase the effects of lobelia.

PHYSIOLOGICAL ACTIONS.—The taste of lobelia is pungent and acrid, and it persists for a long time in the fauces. The leaves chewed excite a very abundant flow of saliva, and soon cause a feeling of epigastric depression and nausea, with giddiness and headache. The preparations of lobelia administered by the stomach produce, in considerable doses, a degree of nausea and depression which amounts to anguish. An abundant outpouring of gastric mucus takes place, and vomiting ensues, with great straining and distress. The action of the heart is enfeebled; headache and vertigo are experienced; a profuse sweat breaks out on the surface of the body; the intestinal canal is relaxed, and the discharge of urine is increased. When a lethal dose is taken, especially if vomiting do not occur, the effects are chiefly expended on the nervous system of animal life. Muscular weakness and trembling, shallow respiration, coldness of the surface, feeble circulation, insensibility, and sometimes convulsions, have occurred. Death ensues from paralysis of the muscles of respiration—the action of the heart continuing after respiration has ceased. The insensibility is doubtless produced in the same way as by tobacco, and the cerebral effects are not the result of a direct action of the poison.

According to the investigations of Ott, lobelia, in moderate doses, first "increases the blood-pressure by acting as an excitant on the peripheral vaso-motor nervous system." This primary effect is not of long duration, a fall in the blood-pressure soon occurs, the peripheral circulation is so embarrassed from weakened power of the heart, and obstructed pulmonary circulation, that oxygenation of the tissue is rapidly impaired, and a marked reduction of temperature takes place. Lobelia affects chiefly the motor nervous system, and especially the medulla oblongata and its respiratory centre (nucleus of pneumogastric).

THERAPY.—Lobelia is much employed by the self-styled physio-medical practitioners as a "sanative agent." The great quantity of mucus discharged from the stomach under its emetic action is considered by them a proof of its power as an eliminating agent. As an *emetic*, lobelia is entirely too harsh and depressant to justify its use for this purpose. In *habitual constipation*, dependent on atony of the muscular layer of the bowel and deficient secretion of the mucous membrane, good results are sometimes obtained by small doses of the tincture—ten minims—administered at bedtime. *Impaction of the cæcum*, when inflammation has not occurred, may be removed, and the bowels induced to act, by small doses, frequently repeated, of the tincture of lobelia (two drops every hour). This remedy can be used when purgatives would produce serious mischief. An infusion of lobelia as an enema has succeeded in relieving *strangulated hernia*, *intussusception*, and *fecal impactions*. This use of the agent is the same as for the corresponding administration of tobacco; it is much safer than tobacco, and may be used to produce as decided therapeutic effects.

Unquestionably the most important application of lobelia is to the treatment of the *asthmatic paroxysm*. It gives relief in a few minutes to violent attacks of spasmodic asthma, and it sometimes happens that the relief is permanent. Frequent repetition of this remedy in the same individual, however, lessens its effects, and it may finally cease to afford any relief. To be effective in asthma, a teaspoonful dose of the acetum or tincture must be administered every fifteen minutes until nausea is induced. Free expectoration and abundant gaseous eructations take place, and the breathing soon becomes easy and calm. The efficiency of lobelia is increased by the addition of iodide and bromide of ammonium. ℞. Tinct. lobeliæ, ℥ j; ammonii iodidi, ʒ ij; ammonii bromidi, ʒ iij; syrup. tolutan., ℥ ij. M. Sig. *A teaspoonful every one, two, three, or four hours.*

Whooping-cough, especially after the cessation of the catarrhal stage, has been treated successfully by lobelia, but we now possess other agents more effective and less disagreeable in action. Lobelia is, however, an excellent *expectorant*. It is adapted to cases in which the cough is dry, resonant, and spasmodic. It succeeds best in those who have attacks of cough with spasmodic difficulty of breathing, and who get up a little tough mucus after long and painful paroxysms of coughing.

A lobelia-emetic will cut short an attack of *spasmodic croup*, but it is too harsh and dangerous a remedy to be employed for this purpose.

Lobelia may be used instead of tobacco in *tetanus*, *strychnia-poisoning*, and allied states.

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Acidum Hydrocyanicum.—*Hydrocyanic or Prussic Acid. Acide hydrocyanique*, Fr.; *Blausäure*, Ger.

Acidum Hydrocyanicum Dilutum.—Diluted hydrocyanic acid. "A colorless liquid having a peculiar odor, and wholly volatilized by heat. It imparts a faint, evanescent red color to litmus, and is not discolored by hydrosulphuric acid. With solution of nitrate of silver, added in slight excess, one hundred grains of it produce a white precipitate, which, when washed with water until the washings are tasteless, and dried at a temperature not exceeding 212°, weighs ten grains, and is wholly soluble in boiling nitric acid."

The officinal diluted acid contains two per cent. of anhydrous acid. Dose, m. j—m v.

Antagonists and Incompatibles.—The metallic salts are, generally, incompatible; also the red oxide of mercury and the sulphides. Freshly-precipitated oxide of iron (hydrated sesquioxide) has been proposed as a chemical antidote, but its action is too slow. In cases of poisoning, the remedies of the greatest utility are cold affusion to the spine, the inhalation of ammonia, the stomach administration, as also the intra-venous injection of this substance. Atropia has been proposed as a physiological antagonist by Preyer; but the rate at which atropia is diffused, as compared with the diffusion of prussic acid, obviously will render such antagonism powerless, how much soever it may be approved on theoretical grounds. The results of experiments, as the author and others have shown, are, however, opposed to the existence of this antagonism. In addition to these measures, artificial respiration should be practised.

Physiological Effects.—Applied to the unbroken skin, it is doubtful whether hydrocyanic acid is absorbed, but in contact with a wound or an abrasion, and with the mucous membrane, it diffuses into the blood with great rapidity.

The vapor has a rather fragrant odor, similar to that of bitter-almonds. Inhaled, it has speedily caused death. When the effects of the vapor are short of lethal, giddiness, faintness, embarrassed breathing, a weak, small pulse, and great muscular weakness, are produced; and there may be even coma and profound insensibility, and yet recovery ensue (Taylor).

In small medicinal doses, beyond a fugitive and very slight calmative effect, no symptoms are produced by it. When the dose somewhat exceeds the medicinal standard, there may occur transient giddiness, nausea, faintness, a feeble pulse, and general muscular weakness. The effects follow very speedily. When a very large toxic dose is taken, a few seconds only intervene from the act of swallowing until its effects are manifest, and death may ensue in two minutes or be postponed to five. Under these circumstances, the following phenomena have been observed: sudden insensibility; eyes protruding and glistening; pupils dilated and unaffected by light; extremities cold, relaxed; the skin covered with a clammy sweat; breathing convulsive, slow; the pulse extremely feeble or imperceptible; evacuations involuntary (Taylor). When the effects are slower, in consequence of the ingestion of a merely lethal dose, there are occasionally tetanic convulsions, opisthotonos, trismus, etc.

Although the effects of prussic acid are exceedingly rapid, a fatal result is not instantaneous. Various acts of volition may be gone through, provided but a few seconds are required for their performance. Several instructive instances of this kind are narrated by Taylor. The effects of hydrocyanic acid are not more rapid than can be accounted for by its distribution through the blood.

Most contradictory opinions have been expressed as to the action of prussic acid on the blood: that it at first arterializes and afterward arrests decarbonization of the blood; that it destroys the ozonizing power, and does not impair the capacity of the red blood-globules to carry and to yield up oxygen; that cyanohæmoglobine is formed by the combination of the acid with hæmoglobine, and that this combination cannot take place, owing to the rapidity of the action of the poison. From this chaotic state of scientific opinion the following may be evolved: the blood is dark, owing to deficient decarbonization, but this is probably due to a spasm of the pulmonary arterioles and paresis of the muscles of respiration, whence it follows that rapid asphyxia ensues. The primary action of prussic acid on the terminal filaments of the pneumogastric, as shown by Preyer, is confirmatory of this view.

Although the action of the heart ceases after respiration, prussic acid undoubtedly exerts a direct paralyzing action on the cardiac ganglia.

The cerebral effects of this poison are, probably, indirect, the result of rapid carbonic-acid poisoning, and the sudden withdrawal of oxygen from the cerebral tissues. Direct application of prussic acid to the medulla oblongata causes (in the alligator) a sudden and complete expiration, and collapse of the lung (Jones). The tetanic convulsions which have been observed in many cases of poisoning, in animals and in man, indicate a direct action of this agent on the spasm-centre; but the disappearance of the excitability of the motor nerves, and of the contractility of muscles which it causes, shows that it quickly exhausts the irritability of the spinal cord. These effects on the cord, on the nerve-trunks, and on the muscles, are also, probably, in part due to the circulation through them of blood deprived of oxygen and charged with carbonic acid. The fact that instances of recovery from a condition of profound insensibility are numerous, is confirmatory of the view just expressed. Moreover, artificial respiration exerts an undeniable influence over the lethal effects of the acid in animals (Preyer), whence it may be concluded that to supply oxygen to the blood is sufficient to arrest all of the symptoms produced by the want of oxygen and by the excess of carbonic acid.

Post-mortem rigidity sets in early after death from prussic acid, and is very pronounced. The fingers are tightly closed, the toes strongly flexed, the jaws rigid, the eyes prominent and staring. The blood is dark-colored, fluid, and the venous trunks and the cerebral sinuses are gorged.

The quantity of medicinal, diluted hydrocyanic acid necessary to produce death will vary with the age, size, and bodily vigor. Habit, also, influences to a remarkable degree the susceptibility to its toxic influence. A quantity equivalent to forty minims of the diluted hydrocyanic acid (United States Pharmacopœia) has proved fatal. As the effects of a medicinal dose are expended in a half-hour to one hour, the repetition of the doses hourly will not be unsafe. Hydrocyanic is not a cumulative poison.

THERAPY.—Hydrocyanic is a remedy of very considerable utility in certain affections involving the functions of the pneumogastric nerve. It is often highly serviceable in various kinds of *nervous vomiting;* for example, the *vomiting of pregnancy*, the *vomiting which accompanies some cerebral disorders*, and the *reflex vomiting of phthisis*. The good effects are quickly, if at all, produced; hence, if no result is attained after some days' administration, no advantage can be expected from its continued administration. ℞. Acid. hydrocyan. dil., ʒ j; aquæ laur.-cerasi, ℥ ij. M. Sig. *A teaspoonful every two to four hours.*

Gastralgia, when it is a truly neuralgic affection of the gastric nerves, is occasionally very quickly cured by this agent. Sometimes cases, apparently in every way suitable for its use, are not improved by it. If a few doses do not effect any amelioration, it will be useless to continue it. Cases of *indigestion accompanied by pain in the nucha, and attacks of giddiness* (stomachal vertigo), are sometimes remarkably relieved by prussic acid. *Irritative dyspepsia*, manifested by these symptoms, a red-glazed tongue, pain, epigastric tenderness, and a feeling of weight and oppression, may be, not unfrequently, much benefited, and, indeed, cured; but while the results are often brilliant, failures are also frequent. *Enteralgia*, a malady often extremely rebellious to remedies, not unfrequently yields promptly to prussic acid.

Considerable medicinal doses of this agent are very fatal to *round worms* (lumbricoides).

Hydrocyanic acid is a successful remedy in *whooping-cough*, after the subsidence of the catarrhal symptoms. It acts by allaying irritability of the pneumogastric, and is successful just in proportion to the preponderance of the nervous symptoms. The cases in which the author has witnessed the best results were cases of *cough by habit*, after the cessation of the whooping-cough proper. The *nervous cough of mothers*, which exists during the presence of whooping-cough in the household, may be allayed by this agent. ℞. Acid. hydrocyan. dil., ʒ j; tinct. sanguinariæ, ʒ iv; syrp. senegæ, ℥ ss; syrp. tolutan., ℥ ij; aquæ lauro-cerasi, ʒ vij. M. Sig. *One or two teaspoonfuls according to age, every three or four hours. For irritable cough.* It sometimes happens that this agent will greatly relieve the *cough of phthisis*, but only when it is chiefly nervous.

To allay *cerebral irritation and excitement*, prussic acid has been employed with benefit (McLeod). In forty cases of *mental disorder* observed by McLeod, there was "slight or temporary amelioration" in ten; a "more decided and permanent effect," the disease being still stationary or progressive, in nineteen; and in eight cases, six of *acute mania*, and two of *acute melancholia*, "the drug has been a factor, and a very main one, in rapid restoration to reason." In the treatment of these cases, McLeod used from two to five minims of Scheele's dilute acid, which contains five per cent. of anhydrous acid. His method of administration consisted in giving it at first at short intervals (every quarter of an hour), and, when effects were produced, every hour or two. He also employed it subcutaneously, in five-minim doses.

External Uses.—In various cutaneous diseases characterized by *itching*, the local application of prussic acid affords relief. The following formulæ, from Fox, represent serviceable combinations: ℞. Bichloride of mercury, gr. j; dilute hydrocyanic acid, ʒ j; emulsion of almonds, ℥ vj. M. *Use in itching, in lichen, in the syphilodermata.* ℞. Dilute hydrocyanic acid, ʒ ss to ʒ j; infusion of marsh mallow, ℥ v to ℥ viij. M. *Use in pruritus.* ℞. Acetate of ammonia, ℥ j; dilute prussic acid, ʒ jss; infusion of tobacco, ℥ viij. M. Sig. *To be sponged on the part twice a day in pruritus ani or p. vulvæ.* ℞. Borax, ʒ j; prussic acid, ʒ ij; rose-water, ℥ viij. M. *In the pruritus of old people.*

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Potassii Cyanidum.—*Cyanide of Potassium.* "In white, opaque, amorphous pieces, having a sharp, somewhat alkaline and bitter-almond taste, and an alkaline reaction. It is deliquescent in moist air, readily soluble in water when reduced to powder, and sparingly soluble in alcohol." Dose, gr. $\frac{1}{10}$—gr. $\frac{1}{6}$.

Antagonists and Incompatibles.—Acids decompose it and set free hydrocyanic acid. As respects its physiological properties, its antagonists are the same as those of hydrocyanic acid.

Synergists.—Same as for hydrocyanic acid.

Physiological Actions.—The effects of this salt have been already mentioned in sufficient detail in the preceding article, so far as they correspond to hydrocyanic acid. It has, however, some special physical properties which separate it slightly from the powerful agent which enters into its composition.

Applied to the unbroken epidermis, the cyanide of potassium produces at first a sensation of coldness, followed by tingling and itching, and in a half-hour the skin is found to be somewhat reddened. Prolonged contact produces a phlyctenular or eczematous eruption.

Systemic effects are produced by the local and external use of the cyanide of potassium, viz., slowing of the pulse and respiration, muscular weakness, drowsiness, and coldness. Lethal effects may follow prolonged contact with the skin, even when the epidermis is unbroken. Applied to a wound or abraded surface this salt causes a burning pain, excites a high degree of inflammation, and produces prompt lethal effects.

Therapy.—Cyanide of potassium may be prescribed as a substitute for hydrocyanic acid in all of the maladies for which the latter is used. This salt has, however, some special applications, which we owe to Trousseau. This eminent observer has shown that a solution of the cyanide applied to the seat of painful sensations gives great relief in various forms of *reflex headache*, gastric, cardiac, pulmonary, and menstrual. The headache which accompanies the pyretic state is, according to the same authority, cured or greatly alleviated by the cyanide solution, while at the same time a favorable influence is exerted over the temperature. ℞. Potassii cyanidi, gr. x—℈j; aquæ lauro-cerasi, ℥iv. M. S. *A compress, moistened with the solution, to be applied to the seat of pain.* From a quarter to a half hour of contact with the skin usually suffices.

A solution of the cyanide of potassium, of the strength given above, will remove the stains of nitrate of silver, and also the dissecting-room odor, from the hands.

Cyanide of potassium, in the form of ointment or solution, is an excellent remedy for allaying irritation in various cutaneous diseases. In *pruritus* and *urticaria*, the following formula (McCall Anderson) gives relief: ℞. Potassii cyanidi, gr. vj; pulv. cocci, gr. j; ung. aq. rosæ, ℥j. M. Sig. *Ointment.* In *eczema, with pruritus*, the same authority recommends the following: ℞. Potassii cyanidi, gr. v; sulphuris, potassii bicarb., āā ʒss; pulv. cocci, gr. vj; axungiæ, ℥j. M. Sig.

Ointment. A solution of the cyanide of potassium is one of the most effective applications for that very troublesome disorder, *pruritus pudendi.* ℞. Potassii cyanidi, gr. xv; aquæ lauro-cerasi, ℥ viij. M. Sig. *Lotion.* This formula is also serviceable in *lichen* and *prurigo* (Hardy).

Entomologists make use of the cyanide to destroy insects without injuring their structures. One part of the cyanide, two parts of plaster of Paris, and one and a half part of water made into a paste and poured into a wide-mouthed bottle, sets into a solid mass, which gives off the vapor of hydrocyanic acid (Squire).

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TROUSSEAU, A. *Clinique Médicale*, vol. ii., p. 332.

Amyli Nitritum.—Nitrite of Amyl. (Unofficinal.) *Nitrite d'amyle*, Fr.; *Amylnitrit*, Gr.

PROPERTIES.—A yellowish or reddish-yellow liquid, rather oily in consistence, very volatile, and having a peculiar and very diffusive ethereal odor. It may contain, as impurities, nitric acid, amylnitric ether, amylvalerianic ether, and hydrocyanic acid. The specific gravity is .877. Dose, m. ij—m. v, by inhalation.

ANTAGONISTS.—The actions of the nitrite of amyl are antagonized by all those agents which increase the functional activity of the spinal cord and sympathetic—as strychnia, brucia, picrotoxine, digitalis, ergot, belladonna, etc. This antagonism may not be available, owing to the difference in the rate at which they are diffused, to affect the system.

SYNERGISTS.—All of the motor depressants increase the effects of the nitrite of amyl.

PHYSIOLOGICAL ACTIONS.—The following are the symptoms produced by nitrite of amyl when inhaled: acceleration of the action of the heart; sudden flushing of the face; dilatation of the arterioles in consequence of paresis of the muscular layer of these vessels; a sense of extreme fullness of the brain, with vertigo; fall in the blood-pressure; lowering of the temperature; complete resolution of the muscular system of animal life. The vapor of nitrite of amyl applied directly to the tissues—muscular or nervous—suspends or completely arrests functional activity. Circulating in the blood, it undoubtedly affects most the vaso-motor nervous system and unstriped muscular fibre.

The marked acceleration of the heart (Pick) is in part consecutive, doubtless, to the sudden dilatation of the arterioles, permitting such an increased quantity of the blood to enter these vessels as to require renewed effort on the part of the heart to supply it; in part, also, to the paretic state which it induces in the inhibitory apparatus. The great fall in the blood-pressure noted by Brunton, Wood, and Ame

Droz, is also due to dilatation of the arterioles, and consequent diminution of tension in the peripheral vascular system. Dilatation of the retinal vessels, when nitrite of amyl is inhaled, has been ascertained by ophthalmoscopic examination (Aldridge).

On the nervous system of animal life the nitrite of amyl acts as a depressant—impairing motility first, and at the last, sensibility. It affects both the spinal cord and the nerves, lessening the sensibility to all forms of irritation, and diminishing the reflex functions. It also impairs the contractility of muscle. Death ensues from failure of respiration, and the cerebral functions are unaffected until carbonic-acid poisoning ensues.

Decided lowering of temperature is produced by the nitrite of amyl. This result is no doubt due to the action of this agent on the hæmoglobine, whereby the carrying capacity of the red blood-globules of oxygen is lessened (Gamgee), metamorphosis of tissue is interfered with, and the generation of animal heat is diminished. A peculiar change ensues in the color of the blood as a result of the lessened oxygenation: all the blood of the body assumes a modified venous hue.

A curious fact has been noted by Hoffman, viz.: the hypodermatic injection of lethal doses of nitrite of amyl produces in rabbits a temporary glycosuria.

Therapy.—The applications of the nitrite of amyl in the treatment of disease have been deduced from a study of its physiological actions. It is especially indicated when morbid symptoms result from vaso-motor spasm. It has been shown that *epileptic attacks* may be warded off by the inhalation of nitrite of amyl, at the beginning of the movement of the *aura*. Patients who have a distinct warning of the seizures should be constantly provided with a small quantity of this remedy in order to practise the inhalation whenever an attack is impending. The mechanism of the action is very simple: the vaso-motor spasm of the cerebral vessels, which is the initial symptom of an epileptic convulsion, is relaxed, and the vessels dilated by the nitrite of amyl.

An attack of *migraine* of that form characterized by vaso-motor spasm (pallor of the face) may be quickly relieved and sometimes aborted by the inhalation of two or three drops of amylnitrite. When there are redness of the face, injection of the conjunctivæ, and fullness of the cerebral vessels, this remedy is contraindicated.

Asthma, when purely spasmodic, is usually quickly checked by this remedy. The paroxyms of difficult breathing which accompany emphysema and cardiac disease are not relieved in this way; indeed, the author has known the most serious distress to be produced by the inhalation under these circumstances.

Exaltation of the reflex function of the spinal cord and muscular spasm are morbid states in which good results may be expected from inhalation of the nitrite of amyl. It has been used with success in *tetanus.* It should also be fairly tried in *strychnia-poisoning* and in *hydrophobia.*

Most signal relief has been obtained from the inhalation of amylnitrite in *angina pectoris.* We owe this important suggestion and practice to Brunton, who had ascertained that when the paroxysm of angina pectoris occurs, a great rise of arterial tension takes place. When the pain, præcordial distress, and anxiety are felt, there should be no delay in the use of the remedy. Some cautions are, however, needed. It may be unsafe when advanced degeneration of the cerebral vessels exists (Anstie). Fatty degeneration of the heart, which is so frequently a cause or an accompaniment of angina pectoris, may also render the use of so powerful a paralyzer of doubtful expediency.

Dr. Mary Putnam Jacobi has found the inhalation of nitrite of amyl very servicable in *neuralgic dysmenorrhœa.* On theoretical grounds this agent was proposed for the relief of *cholera asphyxia* (Brunton, Gamgee), but the trials thus far made with it have demonstrated its inutility. Owing to the fact, shown by Gamgee, that nitrite of amyl combines with hæmoglobine, Brunton proposes that this remedy, if given at all in cholera, must be administered by the stomach or by subcutaneous injection, and not by inhalation.

Repetition in the use of the nitrite of amyl diminishes its effects, and hence increasing doses are necessary when it is often employed in the same case.

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Aconitum.—Aconite. *Aconiti Folia.* Aconite-leaves. *Feuilles d'aconit,* Fr.; *Eisenhutkraut,* Ger.

Aconiti Radix.—Aconite-root. *Racine d'aconit,* Fr.; *Eisenhutknollen,* Ger.

The leaves and root of aconitum napellus. The Indian aconite-root, or *bish,* is supposed to be more powerful than the root of A. napellus, and is preferred for the manufacture of aconitia (Flückiger and Hanbury).

***Extractum Aconiti.*—Extract of aconite. Prepared from the leaves. Dose, gr. ¼ to gr. ss.**

Linimentum Aconiti. — Liniment of aconite (aconite, glycerine, alcohol). For external use only.

Tinctura Aconiti Radicis.—Tincture of aconite-root. Dose, m. j —m. v.

COMPOSITION.—The principal alkaloid is *aconitia* or *aconitine*, which exists in two forms, crystalline and amorphous, and forms with acids crystallizable salts. The crystalline form of aconitia is soluble in chloroform, ether, and alcohol. Aconite contains also another alkaloid which has received various designations—*pseudo-aconitine*, *napelline*, *nepalline*, etc., which is closely allied to aconitia, and is found in commerce under this name. It is but slightly soluble in chloroform, ether, and alcohol, and it exists also in two forms, crystalline and amorphous. Besides the foregoing, another base has been discovered, to which the name *napelline* has also been given. This is an amorphous alkaloid, having strong basic properties, soluble in water, chloroform, and alcohol, but not soluble in ether.

These basic substances are united with a pecular acid—aconitic acid.

ANTAGONISTS AND INCOMPATIBLES.—Alcohol, ether, ammonia, turpentine, digitalis, heat, etc., antagonize the actions of aconite. In cases of poisoning, the stomach should be evacuated, stimulants administered by the stomach and rectum, and external warmth applied. Digitalis has been used with considerable advantage (Fothergill). The intra-venous injection of ammonia may be practised, and artificial respiration resorted to. To overcome the depression of the heart's action, which is the capital point, the hypodermatic injection of atropia is indicated. As the chief danger consists in failure of the heart's action, the recumbent position should be strictly maintained.

SYNERGISTS.—All the agents of this group increase the effects of aconite. Cold, fatigue, and all depressing emotions, are also synergistic.

PHYSIOLOGICAL ACTIONS.—A drop of tincture of aconite placed on the tongue excites a warm and pungent sensation, followed by persistent tingling and numbness. Prolonged contact with the skin causes similar effects upon the sensory nerves. During the medicinal administration of aconite in considerable doses, irritation and a sense of constriction of the fauces are experienced. Large medicinal doses produce gastric pain, nausea, and even vomiting. When the gastro-intestinal mucous membrane is in an irritable state, aconite impairs the appetite, hinders the digestion, and causes diarrhœa, and in the normal state of the membrane increases its secretions and hastens the peristaltic movements.

The systemic effects of aconite follow within a half-hour after its administration. The number and force of the heart-beats are reduced, and the arterial tension is lowered. The action of the skin is increased, and a more abundant urinary discharge takes place. If the quantity has been a full medicinal dose, some muscular weakness, tingling in the tongue, lips, and extremities, are also experienced. The whole duration of the effect is about three hours. When a lethal dose is swallowed, the symptoms begin in from five minutes to a half-hour. In a medical student, who swallowed by mistake a teaspoonful of the tincture of the root, the symptoms began after he had reached the college, having walked from his quarters—the time being about twenty minutes. He experienced an overpowering sense of fatigue in the lower extremities, and he felt, also, great muscular weakness. His eyesight became dim, the globes rather prominent, the pupils dilated. He experienced great dyspnœa, and his respirations were shallow and labored. The pulse was at first slow and small, and at last became imperceptible. The surface of the body, the tongue, and breath, were cold. The skin was covered with a profuse sweat. He was restless, anxious, and sighed frequently; but he had no stupor or convulsions. There were also decided numbness and tingling in the extremities, and in the tongue and lips. Tactile impressions were very faint, and the sense of pain was greatly reduced, so that he seemed almost unconscious of irritants. His temperature fell 2° Fahr. Under the use of heat, brandy, and ammonia, he revived in the course of six hours, and, on the following day, although weak, there were no indications of the effects of the poison.

Aconite affects the sensory nerves before the motor. It paralyzes, first, the end-organs, next the nerve-trunks, and finally the centres of sensation in the cord. Aconite also impairs the reflex function of the spinal cord; but this effect is, doubtless, secondary to the sensory paralysis. The power of voluntary movement continues after the cessation of the reflex functions; but it is finally lost. The arrest of motility is due to the action of the poison on the motor centres of the cord, and subsequently on the nerve-trunks.

Aconite, applied directly to the heart, lessens the number and force of its beats, and finally arrests its action in the diastole. The cardiac muscle, after the cessation of its movements, does not respond to galvanic excitation. Aconite lowers the arterial pressure, as well as lessens the force of the heart-beat. From these facts it may be concluded that it is a direct cardiac poison affecting its ganglia and muscle, and also a sedative to the vasor-motor nervous system. It is also a respiratory poison, in virtue of its paralyzing action on the muscles of respiration; but the action of the heart ceases before the respiratory movements.

Aconite increases elimination by the skin and kidneys. With increased discharge of water, there takes place, also, increased excretion of solids.

THERAPY.—The monopoly by homœopathic practitioners of the use of aconite has aroused a prejudice against it, which has discouraged its employment. Aconite is, however, an antagonist to the fever-process; it is not applicable in accordance with the so-called law of similars. It is used by these quacks because it is a powerful agent which will produce manifest effects in small doses, that may easily be disguised.

The author can quite agree with Dr. Ringer in the statement that aconite is a very valuable medicine, in the class of cases to which it is adapted. It lessens the pulse-rates, lowers arterial tension, diminishes abnormal heat; it therefore antagonizes that condition of the organism known as *fever*. As it also slows the respiratory movements, and thus lessens the amount of work done by the breathing-apparatus, it is especially indicated in *inflammatory states of the respiratory organs*. As it diminishes the sensibility of the sensory nerves, it is useful in certain forms of *neuralgiæ*. As it induces muscular weakness and lowers the activity of the reflex functions, it is indicated in morbid states characterized by an excess of motor activity.

Tonsillitis, *acute pharyngitis*, *ulceration of tonsils*, when accompanied by fever and elevated arterial tension, are greatly relieved by the use of the tincture of aconite. From a half-drop to one drop every half-hour, until an impression is made on the fever-movement, and then every hour or two, is the best mode of administration. In *acute catarrh* (nasal and faucial), *acute otitis*, and in *acute catarrhal bronchitis*, the best results may be obtained by the use of aconite, as above described. The author's observations entitle him to speak with confidence of the good effects of this remedy in *catarrhal* and *fibrinous pneumonia*. It is more especially serviceable before exudations have taken place, but is not without utility at any stage, provided the inflammatory process continues. It not only abates the symptoms, but it favors the removal of the products of inflammation, by increasing elimination through the skin and kidneys. The use of aconite is not incompatible with the employment of other measures which may be needed; but, generally, in fibrinous pneumonia, aconite is sufficient up to the period of crisis. The author has witnessed excellent results from the use of aconite in small doses frequently repeated (one drop every hour) in lowering the temperature of *phthisis*, especially when new districts of pulmonary tissue are invaded by pneumonitis. For the treatment of *acute pleuritis*, previous to the stage of effusion, no remedies are more effective than aconite and opium. ℞. Tinct. aconiti rad., ʒ ij; tinct. opii deodor., ʒ vj. M. Sig. *Eight drops in water every hour or two.* If the pain is severe, a larger dose of opium should be administered, when the effect can be maintained by the quantity directed in the above prescription.

Overaction of the heart, with hypertrophy and without valvular lesion, especially if there be present a condition of plethora, is benefited by a quantity of aconite sufficiently large to moderate the cardiac movements.

Aconite is contraindicated in inflammatory states of the gastro-intestinal mucous membrane. It is very serviceable in *acute congestion of the liver* and *hepatitis*: it diminishes the fever, and, by causing free transpiration, lessens the pungent heat of the skin. *Peritonitis* is best treated by a combination of aconite and opium, as described above for pleuritis. Generally, the opium needs to be given in somewhat larger quantity in peritonitis than in pleuritis. In *pelvic peritonitis*, *puerperal metritis* and *peritonitis*, aconite is indicated, and is of unquestionable utility, provided there be present a condition of sthenic reaction. A condition of adynamia, on the other hand, always contraindicates the use of aconite.

The simple fevers of childhood, *febricula*, *ephemeral fever*, arising from various causes, as cold, fatigue, excitement, etc., are best treated by small and repeated doses of aconite. The remedy induces sweating, and then the fever-movement subsides. The hot stage of *intermittents* and *remittent fever*, if any febrifuge is required, may be relieved of its intensity by frequently-repeated doses of aconite. The *continued fevers* are not benefited by this remedy unless a condition of hyperpyrexia is threatened, when aconite may be used in connection with other antipyretic remedies.

Aconite possesses the highest value in the *eruptive fevers*, especially in *scarlet fever*. There are two conditions of this disease especially requiring the use of aconite—the eruptive stage, and the period of desquamation, if, as is usual, a marked rise of temperature takes place at this period of the disease. Several important purposes are subserved by the use of this remedy; it lowers the fever-heat, favors the action of the skin and kidneys, and checks the nasal, faucial, and aural inflammations, which constitute such troublesome complications and sequelæ. The particular utility of aconite in *measles* consists in its power to arrest the catarrhal pneumonia, one of the most serious complications of this disease. We have no remedy more useful in *erysipelas*—idiopathic, so called, and not arising from trauma; but, on the other hand, Ringer describes an apparently erysipelatous inflammation following vaccination, which is quickly cured by aconite. According to the author's observations, it is facial erysipelas which is most decidedly benefited, and cases characterized by sthenic reaction. When there is a state of adynamia present, the eruption being dusky and the cutaneous circulation languid, belladonna is preferable to aconite. When, in *acute rheumatism*, there are much heat and a dry skin, instead of the usual sweating, aconite is very serviceable. It affords very considerable relief in *muscular rheumatism* when there is much fever.

In acute inflammation of the *cerebral* and *spinal meninges*, and in *cerebro-spinal meningitis* before effusion has taken place, aconite is as serviceable as in other acute inflammations. It is generally advisable to combine opium with it, especially in cerebro-spinal meningitis. In *acute maniacal delirium*, and in mental disorders generally, when there is much motor activity, with vascular excitement and increased arterial tension, aconite is useful, but is not so effective as gelsemium. Aconite renders important service in the *active form of acute cerebral congestion.*

Neuralgia, when accompanied by arterial excitement and muscular spasm, is relieved by aconite; but generally the neuralgias are much more successfully treated by hypodermatic injections and galvanism.

It is asserted by Ringer, and also by Phillips, that sudden *suppression of the catamenial flow*, caused by cold, can be relieved by aconite, in drop-doses of the tincture every half-hour or hour. The author can assert that this remedy has a high degree of utility in *congestive dysmenorrhœa*, occurring in plethoric subjects. These are cases, also, in which gelsemium is so undoubtedly beneficial.

As aconite when locally applied benumbs the sensory nerves, it is frequently used for the relief of *neuralgia.* It is more effective when combined with chloroform (*see* enepidermic method). ℞. Tinct. aconiti radicis, chloroformi, āā ℥ ss; lin. saponis, ℥ j. M. Sig. *Apply to painful point.* A piece of flannel may be moistened with this, laid on the affected part, and covered with oiled silk. A combination of the kind just given is generally more efficient than the officinal linimentum aconiti.

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Veratrum Album.—White hellebore.

Veratrum Viride.—American hellebore.

Extractum Veratri Viridis Fluidum.—Fluid extract of veratrum viride. Dose, m. ij—m. v.

Tinctura Veratri Viridis.—Tincture of veratrum viride. Dose, m. ij—m. v.

Veratria.—Veratria. "Is pulverulent, grayish-white, inodorous, but very irritant to the nostrils. It has an acrid, bitter taste, causing a sensation of tingling with numbness in the tongue. It is very slightly soluble in water, but readily and wholly dissolved by alcohol. It has an alkaline reaction."

Unguentum Veratriæ.—Veratria-ointment. (Veratria, ℈j; lard, ℥j.)

Composition.—Veratrum album, veratrum viride, and veratrum sabadillæ, correspond closely in chemical composition, and the first two in botanical characteristics. Sabadilla is only used as the source of the alkaloid, *veratria.* The alkaloids of veratrum album are *jervia* and *veratralbia* (Mitchell). Veratrum viride contains two alkaloids also—*jervia* and *veratroidia.* The alkaloid jervia, as found in both plants, is the same in chemical action and in physiological effects, and may therefore be considered identical. There are very close affinities between the veratralbia of Mitchell and the veratroidia, first discovered by Bullock, but they are not the same; they differ as respects their chemical relations, and also in physiological properties—veratralbia being much more powerful than jervia and veratroidia. Veratrum album and veratrum viride contain abundance of soft resin, which, when pure, is nearly, if not quite, inert. As the alkaloid jervia is with difficulty separated from the resin, it is probable that the physiological activity, ascribed to the resin by some observers, is really due to the presence of the alkaloid.

Antagonists and Incompatibles.—The effects of veratrum viride on the heart are counterbalanced by alcoholic stimulants, opium, and ammonia. When dangerous symptoms are produced, the recumbent position should be enforced, alcoholic stimulants should be administered by the stomach and rectum, and dry heat should be applied to the body. Ammonia may also be given by the stomach or by intra-venous injection, and, if nausea and vomiting persist, morphia may be administered subcutaneously. The tincture of opium, in stimulant doses, may be prescribed with the alcoholic stimulants.

Synergists.—The vaso-motor depressants, tobacco, lobelia, aconite, etc., are synergistic. Bloodletting, hæmorrhage, purgatives, and all agencies which diminish vital power, increase the effects of veratrum.

Physiological Effects.—In the remarks which follow, veratrum viride only is referred to.

Applied to the skin, veratrum viride excites redness and heat, and, to the Schneiderian mucous membrane, it causes violent sneezing. It is a prompt and efficient emetic, but its operation is accompanied with intense nausea and depression, and the vomiting is often violent and persistent. The contents of the stomach are at first evacuated, and afterward of the gall-bladder, so that it has been supposed to possess the power to increase the secretion of bile. It does not generally purge, but occasionally profuse watery evacuations have been produced by it, and rarely severe hypercatharsis. Its alkaloids enter the blood with facility. The power which veratrum viride has to affect the cardiac movements and the vascular tonus is its most characteristic property. It lowers, in a remarkable manner, the number and force of the cardiac pulsations. The pulse may be reduced to fifty, forty, or even thirty-five per minute, and its force correspondingly diminished. According to Linon, the arterial tension is raised, as shown by the sphygmograph. By very careful administration, this reduction in the pulse-rate may sometimes be accomplished without inducing nausea and vomiting, but usually vomiting cannot be prevented when the remedy is pushed to this extent. When the pulse is reduced very decidedly, the patient being in the recumbent posture, a change to the erect position at once alters its character, and it becomes extremely rapid, thready, and feeble.

Very great depression of the powers of life is produced by large doses. The action of the heart becomes exceedingly weak, the pulse almost indistinguishable, the vomiting and retching extreme, the surface of the body cold and covered with a cold sweat, the temperature reduced. There are also produced faintness, dimness of sight, dilatation of the pupils, giddiness, great muscular weakness, shallow and slow respiration; sometimes somnolence, coma, and insensibility, with stertorous breathing. Notwithstanding the very formidable symptoms produced by large doses, fatal results have been extremely rare. An ounce of the tincture has been swallowed without causing death (Norwood). The prompt emesis which it produces is probably the explanation of its lethal inactivity; for, in the act of vomiting, the medicine is ejected with the first matter from the stomach. Suspension of the medicine and free stimulation quickly remove the most alarming symptoms of depression.

The experimental investigations into the actions of jervia and veratroidia, made by Wood, Peugnet, and others, have shown that the physiological actions of veratrum viride are the sum of the actions of the alkaloids. The nauseating and emetic qualities of the drug are due, chiefly, to veratroidia, and to a slight extent to the resin. Both alkaloids depress the functions of the spinal cord, and destroy its reflex activity; but they do not impair the excitability of the nerves, nor the contractility of muscles. Veratroidia, according to Wood, first stimulates the inhibitory cardiac nerves to an extraordinary extent, and afterward paralyzes them; but the evidence which he adduces in favor of the singular statements on this point are far from satisfactory. Both alkaloids lower the blood-pressure, by diminution of vaso-motor tonus, and paralyze the cardiac muscle, and probably also its contained ganglia. They cause death by asphyxia—by paralysis of the muscles of respiration. The cerebral effects which have been noted in man, and the convulsions in animals, are doubtless due to the accumulation of carbonic acid in the blood.

THERAPY.—The best preparation for administration is the tincture. As the therapeutic properties of V. viride depend, chiefly, on the jervia, an attempt may be made in the future to supply this alkaloid in sufficient quantity for administration; but, at present, the processes involved in its preparation are too intricate and expensive. As the effect of V. viride quickly reaches its maximum, if it be desired to maintain the pulse-rate at a constant level, the doses must not be at a longer interval than two hours. The effect must be maintained by increasing doses, if necessary, and the recumbent posture must be rigidly enforced.

The emetic property of veratrum viride is never applied in practice: too much depression is produced by it. The chief use of this agent is to depress the action of the heart and to lower the vaso-motor tonus. In simple *hypertrophy of the heart*, without valvular lesion, it diminishes the over-action and thus gives relief to the most distressing symptom. The *irritable heart*, so frequently found associated with and dependent on the excessive use of tobacco, on mental excitement and irascibility of disposition, and on overstrain, is relieved by this remedy, provided no valvular lesions coexist. The *hypertrophy of the cardiac muscle*, and the *abnormal arterial tension*, which accompany the chronic form of albuminuria, are alleviated by veratrum viride. Moderate doses of the tincture (five drops *ter die*) usually suffice in these cases. When there are valvular lesions, and when the cardiac muscle is enfeebled from any cause, this agent is inadmissible.

Excellent results are sometimes obtained in *aneurism* by the use of veratrum viride. In the various surgical expedients for the cure of aneurism (forced flexion, compression, ligation), this remedy, used to depress the circulation, renders an important service, by lessening the force with which the blood is propelled, and the number of the cardiac contractions. In this way, coagulation of the blood in the aneurismal sac is greatly favored. In the case of large internal aneurisms—of the innominata, aorta, etc.—veratrum viride is a powerful adjunct to rest and other means of treatment. Some precautions are necessary, however, in the administration of this remedy. As the utmost slowing of the circulation consistent with safety may be required, a sufficient quantity of the tincture must be administered to accomplish this object, and the effect produced is the only measure of the amount to be given. The result must be accomplished, if possible, without causing vomiting. The patient should, therefore, remain absolutely in the recumbent posture, and a little opium should be prescribed with the veratrum viride. *Active hæmorrhage*, occurring in the plethoric, is sometimes stopped by full medicinal doses of this drug.

There can be no doubt that veratrum viride renders an important service in *acute parenchymatous congestion*—of the brain, lungs, liver, and other organs. Its utility ceases when exudations have taken place: its action is confined to the influence which it has in diminishing the blood-supply to the affected organs. The changes produced by inflammation are in no wise affected by veratrum viride. Much that is extravagant has been written in regard to its curative influence in *pneumo-*

nia, but we need not be surprised at this, when we reflect that our knowledge of the natural history of this disease is only of recent origin. Those who knew nothing of the period of crisis of pneumonia naturally attributed the defervescence of temperature to the effect of the remedy. It is not to be denied that in the very incipiency of pneumonia, before fibrinous exudation has taken place, veratrum viride, by lessening the amount of blood circulating in the lungs, may render an important service, but when hepatization occurs its good effects cease. The same observations are true of other parenchymatous inflammations, and equally so of serous inflammations.

Veratrum viride has been much extolled as a remedy for reducing the pulse-rate and the temperature in *typhoid and other fevers* (Norwood). It is true, these effects may be procured by it, but that any influence is exerted in this way, over the course and duration of a fever, seems highly improbable. The chief dangers in fever being the occurrence of cerebral or cardiac paralysis due to the persistent elevation of the temperature, it is unwise to use a powerful cardiac depressant, although it has the power to lower the temperature somewhat. There is, however, a condition of things arising in the course of fevers—viz., *delirium ferox*—in which, when dependent on arterial excitement, much good may be accomplished by the use of veratrum viride.

The excitement of *acute mania*, of *maniacal delirium*, and other forms of mental disorder in which a condition of cerebral hyperæmia may be supposed to exist, is successfully combated by veratrum viride. *Chorea* and *epilepsy* have been reported cured by this agent (Norwood), but a doubt may be well expressed as to the accuracy of these statements.

Veratria is used only externally, and for the relief of *neuralgia*, *headache*, *myalgia*, etc. The officinal *unguentum veratriæ* is the form in which it is employed—a small quantity being rubbed in over the seat of pain.

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Pulsatilla.—Pasque-flower. *Pulsatille*, Fr.; *Küchenschelle*, Ger. (Unofficinal.)

Preparations.—There are no officinal preparations. The tincture is the form usually employed in medical practice, the dose of which varies from one minim to twenty minims.

Composition.—The peculiar powers of the plant depend on the presence in it of an alkaloid—*Anemonin*, a camphor. Anemonin crystallizes in prisms—the regular rhombic system—and is hardly at all soluble in cold water and in alcohol (Husemann). Pulsatilla also contains a peculiar acid—anemonic acid.

Antagonists and Incompatibles.—The caustic alkalies, tannic acid, and the metallic salts generally, are chemically incompatible. From the physiological standpoint, pulsatilla is antagonized by the alcohols, by opium, digitalis, etc.

Synergists.—The effects of pulsatilla are promoted by the paralyzers, especially by the other members of the same family—notably, by aconite, cimicifuga, etc.

Physiological Actions.—The local effects of pulsatilla (the fresh plant) are those of an irritant; and, after prolonged contact, even caustic effects are produced. Applied to the tongue, it gives rise to tingling, burning, followed by numbness—effects very similar to those caused by aconite. On the intestinal mucous membrane it has very pronounced irritating effects. The active principles diffuse into the blood with facility. Depression of the heart's action, lowering of the arterial tension, and declination of temperature, are caused by pulsatilla. It is a paralyzer of motility and sensibility, but, as respects the motor functions, it is not known whether it impairs the contractility of muscle or the irritability of nerve; and, as respects sensation, it has not yet been determined whether the lessened sensibility is due to an influence which this remedy has on the spinal cord, on the nerve-trunks, or on the peripheral expansion—end-organs of the sensory system. Dilated pupils, hebetude of mind, stupor, coma, and convulsions, are cerebral symptoms which occur after a lethal dose has been administered. These cerebral effects may be due to a primary action of pulsatilla on the brain, or to the carbonic-acid poisoning, and the anæmia. When the action of the heart and the respiration are very feeble, carbonic acid accumulates in the blood, and an extreme degree of cerebral anæmia ensues. Coma, convulsions, and insensibility, are natural effects of these causes. Nothing is positively known as to the time and mode of elimination of anemonin, but it is probable that excretion takes place by the kidneys.

The production of any given physiological effect will, of course, depend on the genuineness of the drug. The active principles are volatile, and often disappear in the process of desiccation.

Therapy.—Owing to the irritating action of pulsatilla, it is not suited to the treatment of gastro-intestinal disorders, especially when a state of inflammation exists. Notwithstanding this local irritant effect, homœopathists employ it for the relief of dyspepsia, and the accompanying mental symptoms; but, in coming to conclusions as to its curative value, they calmly ignore the natural history of these maladies.

Pulsatilla is adapted to the treatment of *acute inflammation of the nasal, faucial, laryngeal, and bronchial mucous membrane*—acute catarrh. It is not proper in those cases when accompanied by gastro-intestinal disturbance. It is clearly useful in *acute inflammation of the cerebral and spinal meninges.*

It is used by the homœopathists in the treatment of catarrhal ophthalmia, by internal and local applications; and they hold that it is very efficacious in certain diseases of the uterus, on which organ they suppose it to have a special or specific action. *Sudden arrest of the menstrual flow*, whether caused by moral emotion, or cold, may be relieved, and the effects prevented, by pulsatilla. As aconite is very useful under the same circumstances, it may be assumed that good results may be had by the administration of pulsatilla.

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Grindelia.—The leaves, stems, and flowers, of grindelia robusta.

Composition.—An alkaloid with basic properties has been isolated (Rademaker), but its chemical relations have not been fully made out. The plant contains also a volatile oil, and a resin, to which its physiological activity is doubtless in part due.

Preparations.—Fluid extract. Dose, m. x— ʒ j.

Antagonists and Incompatibles.—Water precipitates the oleoresin. The mineral salts and caustic alkalies are chemically incompatible. Opium, the cerebral stimulants, alcohol, strychnia, picrotoxine, etc., are opposed as respects the physiological actions.

Synergists.—All motor depressants increase the actions of grindelia.

Physiological Actions.—The taste of grindelia is rather pungent, even acrid, and in the stomach it excites a sensation of warmth. The local stimulant effect is such that it promotes the appetite and digestion; but, if too long continued, or in too great quantity, it excites gastric uneasiness. Grindelia slows, somewhat, the heart and respiratory movements. When administered in sufficient quantity, decided cerebral effects are produced. It dilates the pupil and induces sleep. During this condition of hypnotism, the general cutaneous sensibility is much reduced, and reflex movements become sluggish. Motility is also affected, the paresis beginning in the hind extremities. Its toxic powers are by no means great, two drachms of the fluid extract being required to induce sleep in small rabbits. It affects other warm-blooded animals, and also frogs, in the same way. When death ensues, it is from paralysis of the muscles of respiration. Elimination takes place by the pulmonary mucous membrane, and chiefly by the kidneys.

THERAPY.—The most important uses of grindelia, thus far developed, are in the treatment of the *respiratory neuroses*. Its utility in the treatment of *asthma*, especially the so-called *spasmodic asthma*, is certainly great; few cases fail to be relieved at once. Beside the stomach administration, it may be given in the form of fumes, according to the following plan: The plant is steeped in a saturated solution of nitre, dried, when it may be inflamed on an ordinary tin plate, the patient inhaling the fumes as they arise, or the fumes in the air of a small, closed apartment. This preparation may also be rolled into cigarettes, and smoked with or without the addition of tobacco, stramonium, lobelia, etc. The fluid extract of grindelia may be incorporated with other asthmatic remedies, in an extemporaneous prescription. For example: Ext. grindeliæ fluid., ℥ ss; ext. lobeliæ, fl. ʒ ij; ext. belladonnæ, fl. ʒ j; potassii iodidi, ʒ iij; glycerinæ, ℥ iij. M. Sig. A tablespoonful, as necessary.

Cough by imitation and habit, *whooping-cough*, and the *spasmodic difficulty of breathing* which accompanies various pulmonary and cardiac diseases, *hay-asthma*, etc., are helped by grindelia. It is also an effective remedy for *bronchitis*, after the subsidence of acute symptoms; for *chronic bronchitis* and *bronchorrhœa*, and for the bronchitis of *emphysema*.

Besides the above diseases for which grindelia has been used with success, it will prove advantageous in *chronic pyelitis*, *chronic cystitis*, etc. In these diseases local application of the oleo-resin takes place all along the urinary tract.

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CROWE, DR. JOHN E. *Louisville Medical News*, April, 1876.
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Phytolacca.—*Phytolaccæ bacca.*—The fruit of phytolacca decandra—poke-berries.

Phytolaccæ radix.—The root of phytolacca decandra—poke-root.

PREPARATIONS.—*Extractum Phytolaccæ Fluidum.*—Fluid extract of phytolacca. Dose, m. v—ʒ j.

Tinctura Phytolaccæ.—Tincture of phytolacca. Dose, m. x—ʒ j.

COMPOSITION.—An active principle has not been isolated.

Antagonists and Incompatibles.—Alcohol, ether, strychnia, opium, digitalis, etc., oppose the action of phytolacca.

Synergists.—All depressing agents, the paralyzers, and emetics, contribute to the effects of phytolacca.

Physiological Actions.—Poke is nauseant and emetic, and these effects occur, whatever may be the mode of administration. The emesis does not occur at once; there is a slowly-accumulating anguish; vomiting does not result for an hour, and the vomiting is accompanied with great depression.

Phytolacca lowers the rate of cardiac movement and the respiration, but does not alter the rhythm. It is a paralyzer, the loss of power occurring first in the hind extremities. The impairment of motility is not due to an action of this agent on the motor nerve or on the muscle—for the irritability of the nerve and the contractility of muscle remain unaffected when a lethal dose of phytolacca has been given. The action is on the spinal cord, chiefly on the medulla. In rabbits, violent trembling occurs, and convulsions, partly tonic, partly clonic, are produced. Death ensues from paralysis of respiration; for in frogs, when all signs of life have ceased, the heart is found to be in action, on opening the chest. In cases of accidental poisoning, convulsions of a tetanic character have been observed. Elimination takes place chiefly by the kidneys.

Therapy.—Poke has been proposed as an emetic, but the slowness of the action, and the great depression of the powers of life which it causes, have prevented, and will ever prevent, its employment for this purpose.

Alterative powers have been ascribed to it, and cases supposed to be malignant have been cured; but these results were probably instances of the *post* rather than the *propter hoc.* Ulcers, cutaneous diseases, and ophthalmia, are maladies which have been reported cured. The evidence is strong that phytolacca does possess considerable power to promote the healing of varicose and other *ulcers of the leg* (Tidd). A soft extract is spread on muslin, and kept applied to the surface of the ulcer. Obstinate *eczema* has been cured in the same way. The pain and inflammation of *burns* may be assuaged by the same application, and the healing greatly facilitated. How far the effect is merely mechanical does not appear.

It has long been known that phytolacca is a serviceable remedy in *chronic rheumatism.* But the therapeutical application of this remedy most deserving of consideration is the treatment of *inflamed breasts.* There seems to be no reason to doubt that phytolacca possesses the remarkable property of arresting an inflammation of the mamma, and preventing suppuration. For this purpose the fluid extract may be given internally, and the solid extract spread on a cloth and kept applied to the breast, which is the seat of the inflammation. The possession of this property to prevent suppuration in the breast implies the existence of the same property in threatened suppuration in other glandular organs. As the fact is entirely empirical, and rests on no physiological action of the drug, it can only be determined by further trials whether it will check suppuration elsewhere.

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Biggers, Dr. G. W. *The American Journal of the Medical Sciences*, vol. lxv., p. 275.
Dutcher, Dr. A. P. *The Cincinnati Lancet and Observer*, June, 1859.
Tidd, Dr. C. H. *The Clinic*, vol. v., p. 253.
United States Dispensatory, fourteenth edition.

Ailantus.—The bark of A. Glandulosa, a well-known and abundant shade-tree.

Preparations.—Fluid extract. Dose, m. x to ʒ j. Bark, gr. x—ʒ j.

Composition.—The most important constituent is the oleo-resin. It contains, also, a volatile oil, which is extremely diffusible and powerful, and a bitter principle.

Actions and Uses.—The taste is bitter and somewhat acrid. It is strongly nauseant, and the nausea is accompanied with weakness, vertigo, and cold sweating. It possesses decided purgative property, the stools being large and watery. It has considerable power as a vermifuge, and is effective when employed against tænia. The action of the heart is at first increased, but is subsequently slowed, the pulse becoming small and weak. Respiration is similarly affected, and death ensues in animals by paralysis of the muscles of respiration.

On the brain and nervous system ailantus acts as a paralyzer, the loss of power beginning in the hind extremities. The paralyzing action seems to depend on the volatile oil, while the purgative and anthelmintic effects are possessed by the oleo-resin.

Therapy.—The most important application of ailantus is in the treatment of *tape-worm.* For this purpose the oleo-resin, or, better, a decoction of the fresh bark (ʒ j—℥ iv), may be used. The oleo-resin has the advantage in being a permanent preparation, whereas the bark loses its strength in the process of drying.

REMEDIES USED TO CAUSE SOME EVACUATION FROM THE BODY.—EVACUANTS.

EMETICS.

Some of the agents in this group produce vomiting by virtue of a local action on the stomach, and do not affect this viscus when introduced elsewhere. These may be entitled, Emetics by Local Action. There are others which cause emesis, when they enter the blood at any point—Systemic Emetics. The first sub-group of emetics make an impression on the gastric nerves, and an action is at once instituted for their expulsion. The process consists in the transmission of the peripheral irritation to the spinal centre, the generation of a motor impulse, and the consequent action of the nervous and muscular apparatus concerned in the the mechanism of vomiting. The systemic emetics produce their effects through the intermediation of the blood, and the vomiting is only one of the results of the disturbance introduced into the functions of the nervous system.

EMETICS BY LOCAL ACTION.

The most important of these are:

Cupri sulphas, sulphate of copper.
Zinci sulphas, sulphate of zinc.
Hydrargyri sulphas flava, yellow subsulphate of mercury.
Alumen, alum.
Sinapis, mustard.
Scilla, squill.

All of the members of this group have been discussed in other parts of this work, except mustard and squill, and the consideration of these will be more appropriate elsewhere. It is necessary, however, in this place to indicate the nature of the action, the cases to which they are adapted, and the mode of administration of the more important of the emetics belonging to this division.

Cupri Sulphas.—This is a very prompt and efficient emetic. The action begins in a few minutes, and the medicine comes up with the vomited matters. Very little depression follows the emetic effect. It is more especially adapted to the treatment of *narcotic poisoning*, because, the action being local, the obtunded state of the reflex centres interferes less with its operation than is the case with the systemic emetics. It is also occasionally used in *croup*, to effect the dislodgment of the false membrane, but other mechanical emetics are preferable.

Administration.—Dissolve twenty grains of the sulphate of copper in two ounces of distilled water, and give a tablespoonful every fifteen minutes until vomiting occurs. When prompt action is required, as in narcotic poisoning, ten grains of the sulphate of copper may be given at a draught in an ounce or two of water. Its action should be assisted by the free use of diluents.

Zinci Sulphas.—This agent acts in a manner similar to the corresponding copper-salt, but is less powerful It has the advantage of being less likely to induce gastro-enteritis than sulphate of copper, and is, therefore, usually preferred to the latter. It is administered in cases of *narcotic poisoning*, in *croup*, and to relieve the stomach of *indigestible alimentary substances.*

ADMINISTRATION.—In narcotic poisoning a scruple of the sulphate of zinc may be administered in water, and, if need be, repeated once. In croup, or for other purposes, as an emetic, it may be given as follows: Dissolve a half-drachm in two ounces of water, and administer a tablespoonful every fifteen minutes until emesis is produced. The free use of diluents promotes the emetic action.

Hydrargyri Sulphas Flava.—This is one of the most efficient members of this group. It is an active poison, but, as it is returned with the contents of the stomach, no danger attends its administration. It does not act so speedily as copper and zinc. It produces very little nausea, but, when the action begins, the effects are suddenly experienced, and are powerful, without leaving after-depression and sickness. It is not so well adapted to the treatment of narcotic poisoning as the copper and zinc sulphates, but it is the most desirable emetic in the treatment of *croup.* It was formerly much prescribed in this disease as an emetic, but it fell out of fashion until revived recently by Dr. Fordyce Barker. The author's experience in its use is quite in accord with the much more extended experience of Dr. Barker.

ADMINISTRATION.—As the yellow subsulphate of mercury has but little taste, it is easily administered to children. It should be prescribed in the form of powder, rubbed up with sugar of milk. The dose varies from three to five grains. Dr. Barker makes the useful suggestion that powders of this preparation, labeled "croup-powders," should be kept in every household, the children of which have the tendency to attacks of croup. It should be given when the first symptoms manifest themselves, and its repetition will be governed by the state of the breathing.

Alumen.—Powdered alum is a safe, efficient, but slow emetic. About a half-hour usually elapses after it is swallowed before the emesis occurs. It acts mechanically, produces no considerable nausea, and leaves behind no depression. As an emetic its only use is in *croup* and *diphtheria*, administered with the view to cause a detachment of the false membrane. Some effect has been ascribed to the local action of the alum in its passage along the throat, but this opinion is scarcely tenable.

Administration.—A teaspoonful of powdered alum may be administered in sirup, honey, or mucilage. It can be repeated, if need be, every half-hour.

Sinapis.—Mustard is a stimulant, local emetic. It acts promptly and efficiently. In emergencies, other emetics not being available, it may be employed in *narcotic and other forms of poisoning.* As an emetic it is especially adapted to depressed conditions of the system—for, while it causes vomiting, it stimulates the action of the heart. When, therefore, an emetic is indicated, and at the same time the circulation is feeble, the surface cold, and the functions of animal life oppressed, mustard should be used.

Administration.—A tea to a dessert spoonful of powdered mustard should be stirred up in a tumblerful of tepid water, and quickly swallowed. The irritant action of the mustard may be limited, and its emetic action promoted, by the free use of diluents.

Scilla.—Squill is never employed as an emetic by and of itself. It is harsh and rather slow in action. In the form of the compound sirup of squills, it is not unfrequently used for this purpose, especially in domestic practice, but the emetic property of this combination is due chiefly to the tartar-emetic which it contains.

SYSTEMIC EMETICS.

Apomorphia.—An alkaloidal substance obtained by the action of strong acids from morphia contained in closed tubes and subjected to a somewhat elevated temperature. It is obtained also by the action of chloride of zinc in solution on morphia. It is a whitish powder, which becomes greenish by absorption of moisture. It is soluble in water, and it may, therefore, be administered in this menstruum. Dose, gr. $\frac{1}{16}$ to gr. $\frac{1}{8}$. If given hypodermatically, gr. $\frac{1}{16}$ is sufficient; if by the stomach, gr. $\frac{1}{8}$. As it undergoes important changes when in contact with water, the solution for hypodermatic use should be made when required.

Physiological Actions.—Whether injected under the skin or taken into the stomach, apomorphia causes vomiting. The rate at which it moves to affect the stomach depends somewhat on the dose administered. From five to twenty minutes usually elapse after the hypodermatic injection before vomiting begins. The act of vomiting is preceded by very little nausea, the contents of the stomach are usually thoroughly evacuated, and the vomiting recurs a few times at intervals of a quarter to a half hour. In young subjects very considerable depression has been observed to be produced by it, and dangerous symptoms of cardiac paralysis have followed its emetic action in a few instances. These clinical facts seem to contradict the experimental observations of Siebert and Moerz, who have shown that apomorphia does not affect the blood-pressure, and that the pulse rises when emesis comes on, reaches its maximum during vomiting, and declines in the interval. The cardiac depression which has been observed, clinically, may have been the result of idiosyncrasy, yet we should not lose sight of the fact observed by Harnack, that in cold-blooded animals it may be produced experimentally.

Apomorphia causes at first increased rapidity of the respiration, afterward diminishes the force and depth of the movements, and finally arrests them. As this result occurs when the vagi are divided, the drug must necessarily first excite and afterward exhaust the irritability of the respiratory centre. Apomorphia has no appreciable influence on the temperature.

As respects its influence on the nervous system, apomorphia is at first strongly excitant. Afterward it causes muscular tremblings, followed by paralysis and convulsions. The muscular irritability is impaired but not destroyed, and the functions of motor and sensory nerves remain intact; hence it may be concluded that the convulsant action of this agent is due to a direct impression on the spinal cord (the spasm-centre).

THERAPY.—Apomorphia is indicated as an emetic when swallowing is difficult or impossible, and when very prompt action is necessary. As it produces vomiting by its spinal action, profound narcosis will prevent it, and hence, in *narcotic poisoning*, it may fail of effect unless administered before narcosis has supervened. It is a suitable emetic when it is desired to empty promptly an *overloaded stomach.* It is to be preferred to all emetics which must be introduced into the stomach, when this viscus is in a state of inflammation, for it is best given subcutaneously. Apomorphia has been administered as an emetic in *suffocative catarrh*, to empty mechanically the bronchial tubes, but it produced serious depression—a result which might have been *a priori* predicted, since this drug exerts a paralyzing action on the respiratory organs. It has also been given as an *expectorant*, but on insufficient data, for it does not seem to have an effect upon the vagi, and, as above stated, at first it excites the respiration movements, and afterward paralyzes them.

As compared with its congeners, morphia and codia, it is more excitant than morphia and codia, and without their hypnotic and anodyne properties. As respects its convulsant action in animals, it has close physiological relations to narcotina and thebaia. Some clinical experiences have shown (Riegel u. Bohm) that apomorphia causes heaviness in the head, giddiness, drowsiness, yawning, mental hebetude, etc. The trials in which these results were noted were made with Merck's preparation of apomorphia.

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RIEGEL UND BOHM. *Arch. f. klin. Med.*, vol. ix., 2, p. 211, 1871.

SIEBERT, DR. VINCENT. *Untersuchungen über die physiol. Wirkungen des Apomorphia.* Abstracted in *Schmidt's Jahrbücher*, vol. clv., p. 14, *et seq.*

Ipecacuanha.—Ipecacuanha. The root of cephælis ipecacuanha. *Racine d'ipécacuanha*, Fr.; *Brechwurzel*, Ger.

Extractum Ipecacuanhæ Fluidum.—Fluid extract of ipecacuanha. Dose, m. ij—ʒ j.

Syrupus Ipecacuanhæ.—Sirup of ipecacuanha (fluid extract, ℥ ij; sirup, ℥ xxx). Dose, ʒ j—℥ ss.

Trochisci Ipecacuanhæ.—Troches of ipecacuanha (ipecac., tragacanth, arrow-root, sugar, and sirup of orange-peel). Dose, one or more. Each troche contains one-fourth of a grain of ipecacuanha.

Trochisci Morphiæ et Ipecacuanhæ.—Troches of morphia and ipecacuanha (each troche contains one-fortieth of a grain of morphia, and one-twelfth of a grain of ipecac.).

Vinum Ipecacuanhæ.—Wine of ipecacuanha (fluid extract of ipecac., ℥ ij; sherry wine, ℥ xxx). Dose, m. i—ʒ j.

Pulvis Ipecacuanhæ Compositus.—Compound powder of ipecacuanha. Dover's powder. Ten grains contain one grain each of ipecac. and opium, and eight grains of potassium sulphate. This preparation has already been discussed in the article on opium, and requires no consideration here.

COMPOSITION.—Ipecacuanha contains an active principle, designated *emetia* or *emetine*. This exists in the bark of the root, in combination with a peculiar acid—*ipecacuanhic acid*. The alkaloid is found in the root in a proportion somewhat less than one per cent. It is a bitter, inodorous, and amorphous substance, colorless, and alkaline in reaction. It is freely soluble in chloroform and only slightly so in ether. Ipecacuanhic acid is a glucoside, and is chemically related to kinic and caffetannic acids.

ANTAGONISTS AND INCOMPATIBLES.—The salts of lead and mercury, the vegetable acids and astringent infusions, are incompatible. The tannate of emetia is extremely insoluble. Bismuth, carbolic acid, hydrocyanic acid, and narcotics generally, hinder its emetic action.

SYNERGISTS.—The emetics—those by local action and the systemic—favor the vomitive action of ipecac. Its effects on the skin and bronchial mucous membrane are promoted by opium, warm diluents, etc.

PHYSIOLOGICAL ACTIONS.—Inunctions of ipecacuanha excite very considerable irritation of the skin: at first, small isolated pustules appear, and these are followed by large pustules and ulceration (Duckworth). When applied to the mucous membrane of the nares, it produces a sensation of heat and causes sneezing. Some persons are so susceptible to its action that the smallest quantity inhaled will induce an asthmatic paroxysm.

Administered by the stomach in small doses (from one-eighth to one-quarter of a grain), ipecacuanha acts as a stomachic tonic, and probably increases the gastric secretions. In larger doses (from five grains to a scruple), it is nauseant and emetic; but the sickness which it causes is not severe, and the vomiting is not accompanied nor followed by much depression. Its action as an emetic is rather slow, from twenty minutes to a half-hour being required, and is not persistent. Repetition of large doses will, in most cases, but not invariably, produce a condition of *tolerance*, when vomiting does not occur, but a cathartic action is induced, the stools having a peculiar bilious character, appropriately designated "ipecacuanha-stools." Both vomiting and purging are sometimes produced by an emetic of ipecacuanha.

Like other nauseants and emetics, ipecac. increases the secretions of the broncho-pulmonary mucous membrane, and is therefore held to possess *expectorant* properties. More than any other agent of the class, it relaxes the skin, and promotes cutaneous transpiration.

Ipecacuanha exerts but little influence over the circulation. In animals, lethal doses of emetia cause death by paralysis of the muscles of respiration, the heart continuing in action after the cessation of the respiratory movements (D'Ornellas). The temperature of the surface falls, but the internal temperature remains the same, or rises somewhat, owing, it is said (D'Ornellas), to the irritant action of the agent on the intestinal mucous membrane.

In the *post-mortem* examination of animals killed by emetia, very considerable gastro-intestinal irritation is found. The lungs are sometimes seen to be hyperæmic and presenting patches of hepatization, and sometimes exsanguine, but the former condition is more frequently observed. As the most common state of the lungs, caused by lethal doses of ipecac., is similar to that which is induced by section of the vagi, it is a reasonable conjecture that it has a special action on these nerves—according to Chouppe, on the terminal filaments of the vagi. The elimination of emetia takes place in large part by the gastro-intestinal mucous membrane, and is found in the secretions.

THERAPY.—For ordinary purposes no emetic is more safe and efficient than ipecacuanha. As it causes but little depression, and is free from irritant effects in ordinary doses, it may be given in conditions of the system in which tartar-emetic and the other mineral emetics are inadmissible. When the stomach is to be relieved of *indigested aliment*, ipecacuanha is the most suitable emetic. Attacks of *acute indigestion*, *migraine*, and the so-called *bilious sick-headache*, may not unfrequently be cut short by an ipecac.-vomit. The good effects of the vomitive treatment are, not unfrequently, most strikingly exhibited in the beginning of *continued fevers*, the *eruptive fevers*, *erysipelas*, and *periodical fevers.* It has been alleged that fevers are sometimes "aborted" in this way. In denying the possibility of such results, it must be admitted that clinical experience has shown the good effects of the practice on the subsequent course of the malady. Formerly an ipecacuanha-emetic was much more frequently employed at the outset of fevers than is the fashion at present, and the author is convinced that this mode of treatment should be resorted to now in suitable cases. The indications for the use of emetic doses of ipecacuanha, in the fevers above-named, are these: a heavily-coated tongue, much nausea and ineffectual efforts to vomit, a strong sense of epigastric oppression, icterus or an icterode hue of the surface, a hot and dry skin, acid and turbid urine. When these symptoms are present in cases of *malarial fever*, the antiperiodic remedies will be much more effective in their action if their administration has been preceded by an ipecacuanha-emetic.

In all the cases in which emetics are employed for mechanical effects, as in *membranous croup*, *capillary bronchitis*, *foreign bodies lodged*, etc., ipecacuanha may be used. In croup it is not so effective as the yellow subsulphate of mercury; in capillary bronchitis, as tartar-emetic; but, as respects the latter disease, ipecacuanha is to be preferred in the very young or very old, and in those debilitated by any cause. In the domestic treatment of *laryngismus stridulus* an emetic dose of the sirup of ipecac. is the most usual remedy.

As an emetic twenty grains of the powder of ipecacuanha may be diffused in a cup of warm water, and a tablespoonful of the mixture exhibited every fifteen minutes until emesis occurs. Two grains may cause vomiting, and four grains will usually act efficiently; hence a good method of proceeding, when an emetic effect is desired, is to exhibit a powder of four grains in a tablespoonful of warm water every fifteen minutes until vomiting occurs. The action will be facilitated by drinking freely of warm water; but, if the systemic impression of the ipecacuanha is desired, the patient should retain the recumbent posture, and all fluids should be withheld. If the cathartic as well as the emetic action is sought for, some weak animal broth should be given when the stomach is emptied of its contents. If free action of the skin is to be promoted, as soon as the vomiting has ceased warm aromatic infusions should be administered, and the patient should be covered with blankets.

It has long been known that ipecacuanha, in small doses, has the power to arrest certain kinds of *vomiting.* Attention has recently been recalled to this curious fact. It is in *nervous vomiting* more especially that this remedy is useful: for example, in the *vomiting of pregnancy*, *vomiting of drunkards*, *vomiting of migraine*, etc. A minim of the vinum ipecacuanhæ, given every half-hour or hour in a little water, will sometimes relieve these cases in a very remarkable manner; but it very frequently fails, and there are no indications at present known which will enable the practitioner to determine beforehand whether it will or will not be successful.

It is a singular fact, showing the remarkable phases through which professional opinion passes, that ipecacuanha, which was introduced at the close of the seventeenth century as a remedy for *dysentery*, after a time ceased to be employed in this disease, but has again been restored to the estimation in which it was originally held. *Epidemic dysentery*, especially of malarious and tropical countries, is the form of the disease to the cure of which ipecacuanha seems best adapted. The author has used it with much success in *acute dysentery*, as it occurs in the interior valley of this continent. When the characteristic ipecacuanha-stools are produced the tormina and tenesmus cease, and the dejections soon become feculent; the skin, previously dry and hot, becomes moist and cool, and a refreshing calm is experienced. Large doses of ipecacuanha are required in the treatment of acute dysentery. In the severe attacks of tropical regions, from twenty to sixty grains are given for the initial dose, and the quantity subsequently administered depends on the effect —usually about twenty grains every four, six, or eight hours. It is important to establish *tolerance* of the remedy as speedily as possible. If the first dose be rejected, subsequent ones may be retained. Various expedients may be resorted to in order to secure the retention of these large doses. The ipecacuanha may be combined with some opium and aromatic powder: ℞. Ipecacuanhæ, ʒ ss; opium, gr. j; pulv. aromat., grs. v. M. ft. pulv. no. j. After the dose of ipecacuanha is administered a sinapism may be applied to the epigastrium, and an enema of laudanum and starch, or the subcutaneous injection of morphia, may be practised. Milk is an excellent vehicle for the administration of ipecacuanha. In the cases of dysentery treated on this plan by the author, he has found that doses of fifteen grains, given in milk, were generally pretty well borne. It not unfrequently happens, however, that tolerance cannot be established, and the remedy must then be abandoned. Some patients so object to the nausea produced by it as to be reluctant to take it, and others, after one trial, decline to continue the treatment. Notwithstanding these drawbacks, it must be conceded that ipecacuanha is a most valuable remedy in epidemic and sporadic dysentery. It has been shown that in India, before the introduction of this method of treatment, the mortality from dysentery was about 79.6 per one thousand of cases; but, since the use of ipecacuanha has been generalized, the mortality has fallen to 20.15 per one thousand of cases.

Ipecacuanha has also been used with success in *chronic dysentery*, but, in the author's experience, it is by no means so beneficial as in the acute. It succeeds best in those cases which are the outgrowth of acute attacks, and in which the intestinal ulcerations are not far advanced. The rules for its administration are the same in chronic as in acute dysentery. In the *summer dysentery* and *diarrhœa of teething children* ipecacuanha is often extremely serviceable. The special indication for its use is the occurrence of greenish stools, containing mucus and sometimes blood. These stools are usually voided with much pain and straining. At the same time the skin is harsh and dry, the tongue rather dry and pasty, or glazed, and there is great thirst, although little or no fever may be present. Ipecacuanha changes the character of the stools, induces perspiration, and allays the thirst and dryness of the mouth. From two to five grains every two hours may be given in these cases, or it may be administered with pepsin, oxide of zinc, bismuth, or other remedies. ℞. Ipecacuanhæ, grs. xij; bismuthi subcarb., ʒ j; pepsinæ sacch., ʒ ss. M. ft. pulv. no. xij. Sig. *One in milk every two hours.*

The evidence is conclusive that ipecacuanha possesses very valuable antihæmorrhagic powers. It has been successful in *hæmoptysis*, *epistaxis*, *menorrhagia; post-partum hæmorrhage*, etc. As Peter has observed, "the vomitive medication" (ipecacuanha) "arrests not only hæmoptysis but all kinds of hæmorrhage, and is, therefore, a general antihæmorrhagic medication." In hæmorrhages the ipecacuanha should be given in frequently-repeated doses until vomiting ensues; usually, when this effect is produced the hæmorrhage ceases. Other antihæmorrhagic agents may be combined with ipecacuanha. ℞. Ext. ipecac. fluidi, ʒ ij; ext. ergotæ fluidi, ʒ iv; ext. digitalis fluidi, ʒ ij. M. Sig. *Thirty minims to a teaspoonful at a dose, as required.* The author has witnessed excellent results from this combination in hæmoptysis and menorrhagia. In the treatment of *post-partum* hæmorrhage, the most suitable combination is fluid extract of ipecacuanha and fluid extract of ergot. Trousseau strongly urges the employment of ipecacuanha in *post-partum* hæmorrhage, and, indeed, in the various accidents which occur in the *puerperal state*, among which he designates gastro-intestinal irritation, suppression of the lochia, subacute metritis, pelvic cellulitis, bronchial catarrh, subacute pneumonia, etc. "He has not observed the least ill-result from this practice; on the contrary, in the most of these cases, he has obtained either a cure or a notable amendment" (Trousseau et Pidoux).

Certain acute affections of the broncho-pulmonary mucous membrane are much benefited by non-emetic doses of ipecacuanha, for example, *acute catarrh of the nasal and bronchial mucous membrane*, *hay-asthma*, *capillary bronchitis*. An emetic dose will cut short an attack *of laryngismus stridulus*. An occasional emetic gives great relief in *whooping-cough*, when there is profuse bronchial secretion. Non-emetic doses of the fluid extract (m. j—m. iij) diminish the violence of the spasms in this disease. Nauseating and emetic doses are serviceable in the attacks of *spasmodic asthma*, but the good effects of the remedy are lost by repetition. Ordinary *colds*, especially in children, are benefited by doses sufficient to produce slight nausea but not vomiting. A troublesome cough at night, which prevents sleep, may not unfrequently be arrested by a dose at bed-hour of some one of the ipecacuanha preparations. For these various purposes the wine or the fluid extract may be used, but the latter preparation is much more trustworthy and effective than the former.

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Antimonii et Potassii Tartras.—Tartrate of antimony and potassa. Tartar-emetic.

This is a powerfully spoliative and depressing emetic, which has already been discussed under the head of "Agents promoting Destructive Metamorphosis." It was formerly much employed as an emetic in croup, capillary bronchitis, and at the onset of fevers and inflammations; but the local irritation, as well as the systemic depression which follows its use, has led to its almost entire abandonment for these purposes.

ADMINISTRATION.—Six grains may be dissolved in four ounces of water, and a tablespoonful be given every fifteen minutes until emesis occurs. Ipecacuanha and tartar-emetic are frequently administered together—twenty grains of the former and two grains of the latter.

CATHARTICS.

Purgatives are divisible into several groups, according to the nature of their action.

Laxatives are medicines which stimulate the intestinal movements, without increasing, to any considerable extent at least, the intestinal secretions.

Saline Purgatives excite increased secretion, while at the same time they hasten the peristaltic action. The dejections which are produced by them are loose and watery.

Mercurial Purgatives, chiefly calomel and blue mass, exert an influence peculiar to themselves. Without expressing an opinion at present, for or against their supposed cholagogue effects, the author believes that they differ so much in their action from other purgatives as to be appropriately placed in a separate class.

Tonic-astringent and Resin-bearing Purgatives.—These affect the liver and the glandular appendages of the mucous membrane, and increase the tonicity of the muscular layer of the intestine. They increase the proper secretion of the glands, and do not merely cause an outward osmosis of fluid from the vessels.

Hydragogue Purgatives act with great energy, and not only increase the glandular secretions, but cause a very abundant outward osmotic flow, so that the dejections which they produce are extremely watery. This group of purgatives also excite very rapid and violent peristaltic movements.

Laxatives.—*Manna.*—Manna. "The concrete saccharine exudation, in flakes, of fraxinus ornus, and of fraxinus rotundifolia." Dose, ʒ j—℥ ij, according to age.

COMPOSITION AND PROPERTIES.—Manna has a sweetish, rather mawkish taste; is soluble, when pure, in three parts of cold water, and in its own weight of boiling water. It contains a sugar—*manna-sugar*, or *mannite*, which constitutes from seventy to eighty per cent. of the best specimens of manna. It is said to contain dextrine, or a mucilage having similar reactions, and ether extracts from it in small quantity a slightly acrid, reddish-brown resin, on which the laxative property of manna probably depends.

ACTIONS AND USES.—Manna is a very mild laxative, but, when administered alone, is apt to cause griping. It is rather slow in its operation, but is free from irritating qualities, and leaves no unpleasant after-effects. It is most frequently combined with other purgatives—senna chiefly—the operation of which it aids, and at the same time renders less drastic. It is rarely given alone, and only to children and pregnant women. Formerly it was used as a laxative in hemorrhoidal affections.

Sulphur.—Sulphur lotum (washed sulphur). Sulphur sublimatum (sublimed sulphur). Washed sulphur should only be used as a laxative. Sublimed sulphur contains a trace of acid which imparts to it a griping quality. Dose, ʒ j—ʒ iij.

ACTIONS AND USES.—Sulphur is insoluble in water, but dissolves in alkaline solutions and in the volatile and fixed oils. In the small intestine, sulphur is placed under favorable conditions for absorption. That it does enter the blood is proved by the fact that it appears in the perspiration, urine, milk, etc. Silver coins, carried in the pockets of those taking sulphur, are discolored by the formation of the sulphide of silver. Considerable sulphuretted hydrogen gas is produced as a result of the chemical changes in the intestines, and a quantity of offensive flatus is an unpleasant sequel of its administration. The intestinal secretions are somewhat increased by it, and the stools are therefore softer. It is a very mild laxative. Combination of sulphur and bitartrate of potassa or magnesia is occasionally resorted to, especially in domestic practice, for the purpose of increasing the laxative action.

Sufficient attention has already been paid to the sulphur compounds, and it only now remains to speak of sulphur as a laxative. It is used chiefly to render the stools softer and more easily voided in cases of *hæmorrhoids*, *fissures of the anus*, and after *surgical operations about the pelvic organs.* It is used also as a laxative in *skin-diseases*, *chronic rheumatism*, *sciatica*, and *lead-cachexia*, conjoined usually with sulphur-baths, the sulphurous mineral waters, and other appropriate medication.

Administration.—A teaspoonful or two of washed sulphur may be given mixed with sirup at bedtime. A teaspoonful of sulphur, and the same quantity of cream of tartar or magnesia, may be administered in the same way.

Magnesia.—Magnesia. Magnesii carbonas (carbonate of magnesia).

Actions and Uses.—A mild antacid laxative. In the stomach it neutralizes any free acid it meets with, and the resulting salt has a laxative action. It is used to correct *acidity*, the carbonate being preferred when there is an irritable state of the stomach, because the carbonic acid, which is set free by the action of the stomach acid, is a local sedative and anodyne. If magnesia does not enter into combination with the stomach acid, no laxative effect is produced. Under these circumstances a solution of citric acid or lemonade, taken after the magnesia, will cause it to act. Magnesia is a useful antacid and laxative in *sick-headache*, especially when accompanied by acidity and constipation. It has been employed also in *gouty affections*, and in *lithiasis* (uric acid); but it is much inferior to the potash salts in these affections. In the intestinal indigestion of infants, attended with flatulence, magnesia is much prescribed in conjunction with carminatives. The following is Dewees's formula for *flatulent colic* and *diarrhœa* in infants: ℞. Magnesii carbonat., ʒ ss; tinct. asafœtidæ, gtt. xl; tinct. opii, gtt. xx; sacchari, ʒ j; aquæ destil., ℥ j. M. Sig. *Twenty drops to a teaspoonful, according to age.* The carminative of Dalby is similar in composition: ℞. Magnesii carbonat. ℈ ij; ol. menth. pip., gt. j; ol. myrist., gtt. ij; ol. anisi, gtt. iij; tinct. castor., gtt. xxx; tinct. asafœtid., gtt. xv; tinct. ol. hedeomæ, gtt. xv; tinct. cardam. comp., gtt. xxx; aquæ menthæ pip., ℥ ij. M. Sig. *A teaspoonful, as necessary.*

Magnesia is frequently combined with other purgatives because of its antacid property. The following is Meigs's formula, gelsemium having been substituted for henbane: ℞. Magnesii carb., ʒ ss; magnesii sulphat., ʒ iij; spts. ammoniæ aromat., ʒ j; tinct. rhei, ℥ ss; tinct. gelsemii, ʒ ss; aquæ menthæ pip., ℥ iv. M. Sig. *A tablespoonful two or three times a day.*

It is unsafe to use magnesia in large quantity for lengthened periods, owing to the fact that it may form intestinal concretions—a hydrate of magnesia. Instances of this kind have been reported.

Freshly-precipitated hydrate of magnesia is an antidote to arsenious acid in solution, but it is not so effective as the hydrated sesquioxide of iron.

Oleum Ricini.—Castor-oil. *Huile de ricin*, Fr.; *Castoröl*, Ger. The fixed oil as obtained from the seed of ricinus communis. Dose, ʒ j—℥ j.

Properties and Composition.—Castor-oil has a pale amber-color, a rather nauseous taste, and is quite viscid. Cold increases the viscidity. It has a specific gravity of about 0.96. It contains several fatty acids—*palmitic* and *ricinoleic*—the latter peculiar to castor-oil. The seeds appear to contain a drastic constituent, which is more powerfully purgative than the oil. The purer the oil, the less active its purgative property.

Actions and Uses.—Castor-oil is a mild but very certain and efficient laxative. It operates in from four to six hours, causing but little pain, and producing copious stools. It increases but slightly the intestinal secretions—hence the stools are not very liquid. Its purgative principle enters the blood, and the milk of the mother may in this way acquire a purgative property. It does not appear to have any effect upon the hepatic secretion. Röhrig's experiments, which demonstrated this point, have been confirmed by the subsequent investigations of Rutherford and Vignal. After the action of castor-oil has been completed, it may not unfrequently be seen floating on the stool; yet Buchheim (Husemann) has been unable, after careful examination of the fæces, to discover in them castor-oil or any of its derivatives.

Castor-oil is justly held in great esteem as a *laxative for children, for pregnant women, for the puerperal state.* When *hardened fæces* and *irritating substances* are to be removed from the intestinal canal, castor-oil is the most efficient purgative compatible with safety. When *inflamed hæmorrhoids, fissures of the anus*, or *surgical operations on the pelvic viscera*, require the use of a mild, certain, but unirritating laxative, castor-oil should be selected. Unfortunately, its taste is so repugnant to many palates, that no considerations will overcome the disgust which it excites. No remedy is more useful in the *diarrhœa of children*, induced and maintained by undigested aliment or irritating secretions. It is judicious practice, in these cases, to give a laxative dose of castor-oil to empty the canal, and follow it with an opiate or enema of laudanum. The *dysentery of children*, and *sporadic dysen-*

tery of adults, especially after the more acute febrile symptoms have subsided, are generally very successfully managed by an emulsion of castor-oil: ℞. Ol. ricini, ℥j; mucil. acaciæ, syrp. simplicis, āā ℥ss; aquæ cinnamomi, ℥ij. M. Sig. *A tablespoonful every four to six hours.* In cases of dysentery, when there are much pain, tenesmus, and frequent passages, ten to twenty drops of laudanum may be added to each dose; when there are much depression, a low state of the arterial tension, and a dry, glazed tongue, five drops of turpentine may also be added.

A poultice made of the leaves of the castor-oil plant applied to the breasts, it is said, has the power to promote the secretion of milk. Warm applications to the mammæ undoubtedly stimulate their functional activity, but it is questionable whether castor-oil leaves have a special galactagogue property. It is said, however, that the inhabitants of the Cape Verd Islands have long been acquainted with this supposed property. The internal use of a fluid extract of the leaves has also, it is supposed, the power to determine an increased secretion of milk. Jaborandi will probably prove to be more effective in this respect than the ricinus communis.

Saline Purgatives.—Many of these have been discussed elsewhere; some of them are no longer employed in medical practice. The sulphate and the citrate of magnesium may be regarded as typical representatives of the class, and hence, in a statement of their physiological actions and therapeutical applications, may be comprehended all that is immediate and of practical value on the subject.

Magnesii Sulphas.—Sulphate of magnesia. *Sulfate de magnésie*, Fr.; *Bittersalz*, Ger. "In colorless crystals, which slowly effloresce on exposure to the air, and are very soluble in water." Dose, ʒj—℥j.

Magnesii Citras (Liquor, officinal).—In two forms: 1. As a granular salt, consisting of citrate of magnesium, bicarbonate of soda, and citric acid; 2. In solution (*liquor magnesii citratis*) in a tightly-secured corked bottle. A tablespoonful of the granular salt added to a half-tumblerful of water, and drunk during effervescence, is the quantity and the form in which it is taken. The bottled solution, which is also highly effervescent, must be drunk immediately on being poured out. It is a pleasant drink, and, when properly prepared, an active cathartic.

PHYSIOLOGICAL ACTIONS OF SALINE PURGATIVES.—As a general rule, saline cathartics are easily borne by the stomach; especially is this true of the Epsom salts. The purgative action is due chiefly to increase of the intestinal secretions, and hence the stools are large and watery. Thiry and Radziejewski had apparently demonstrated that all purgatives acted by increasing the peristaltic movements, but exactly opposite results have been obtained by Moreau, whose observations have been confirmed by Vulpian and Brunton. The conclusion reached by the last-named observer is expressed as follows: "Such positive results as these seem to prove that purgatives do cause a flow from the intestinal wall, quite as conclusively as experiments with Thiry's fistula do the opposite; and, as the conditions under which the purgatives act on the intestines more nearly approach the normal in Moreau's than in Thiry's experiments, there can be little doubt that purgatives produce a decided secretion of fluid from the intestines, as well as accelerate peristaltic movements." Of the agents employed by Brunton in his experiments —croton-oil, elaterine, gamboge, jalapin, and sulphate of magnesia—the greatest secretion was caused by the latter. The results of the best directed experiments are, therefore, in accord with clinical observations, and it may hence be considered as established that saline cathartics produce an outpouring of fluid into the intestinal canal. This outward osmosis occurs chiefly from the vessels, and is not truly a secretion of the glandular appendages of the mucous membrane.

THERAPY.—The saline purgatives are indicated in *acute inflammatory affections*, as a part of the denutrition treatment. If the arterial tension is abnormally high, purgatives, especially the salines, lower it, as the sphygmographic tracings slow. When a considerable quantity is withdrawn from the intestinal vessels, the blood-pressure is necessarily diminished elsewhere (Brunton). Free transudation from the blood-vessels of the intestinal canal lessens the amount of work which the kidneys have to do, and, if these organs are hyperæmic, removes the congestion. Saline cathartics are therefore very important remedies in the treatment of *renal and cardiac dropsy*. Free purgation, also, influences the condition of the kidneys by reflex action. As a result of the lessened hyperæmia of the kidneys, the diminution of the blood-pressure, and the reflex stimulation of these organs, the action of a purgative is often followed by greatly-increased activity of the renal function. In *ascites* from obstruction of the portal circulation, saline cathartics are even more conspicuously beneficial than in general dropsy —for in this case they affect directly the organs involved. *Cholæmia, uræmia, œdema of the brain, increased intra-cranial blood-pressure* from any cause, are conditions requiring the use of active saline cathartics.

The most important applications of saline cathartics are in the treatment of various intestinal disorders. When the stomach is irritable, and the intestines inflamed, no other purgative is so well borne as Epsom salts, and its use may be resorted to, when any other agent of the kind would be inadmissible. *Impaction of the cæcum* and *typhlitis*, resulting from this cause, may be removed by the proper administration of this remedy. It is unsafe, by active and drastic purgatives, to attempt to unload the bowel—for these harsh measures will only aggravate the existing inflammation. Epsom salts will liquefy the fecal masses and deplete the vessels, and thus remove the obstruction without causing any irritation. Small doses frequently repeated are more suitable than a large purgative dose. Usually about a teaspoonful in a wineglassful of water, every three hours, will be the quantity required. Perityphlitis and the peritonitis arising from inflammation and perforation of the *appendix vermiformis* are conditions in which purgatives of any kind are inadmissible.

The constipation which accompanies *lead-colic* can be overcome by Epsom salts. ℞. Magnesii sulphatis, ℥ j; acidi sulphuric. dil., ʒ j; aquæ, ℥ iv. M. Sig. *A tablespoonful every three hours.* As Brunton has pointed out, the administration of Epsom salts is a very important expedient in the treatment of the *saturnine cachexia.* Lead, as well as other minerals, mercury and copper, for example, is eliminated with the bile, and is discharged into the intestine, where it is again absorbed. For an indefinite period, therefore, the absorption and discharge of the same metal may be going on; and hence the utility of giving purgative doses of Epsom salts during the treatment of lead-poisoning.

The most efficient treatment of *acute dysentery* is by the administration of sulphate of magnesia. It is especially adapted to the acute stage when there are fever, pain, tenesmus, and stools of mucus and blood. It lessens the hyperæmia and causes fecal evacuations, with the result of relieving the pain and the distressing straining. It is administered as follows: Take a sufficient quantity of sulphate of magnesia to saturate seven ounces of water, and to this saturated solution add one ounce of diluted sulphuric acid. The dose of this is a tablespoonful every hour or two, in a wineglassful of water, until it operates. Sulphate of morphia may be combined with it, or starch enemata with laudanum may be employed.

The *bleeding from hæmorrhoids* may sometimes be arrested by the above-described solution of Epsom salts and sulphuric acid, especially if the state of the hæmorrhoidal vessels be due to constipation. *Uterine hæmorrhage* caused by the presence of a fibroid, or by *subinvolution*, and *congestion of the pelvic viscera*, are not unfrequently relieved by the same agent when other agents apparently more powerful fail. When congestion of the pelvic organs, constipation, and anæmia coexist, the following is an efficient remedy: ℞. Magnesii sulphat., ℥ j; ferri sulphat., manganesii sulphat., āā ℈ j; acid. sulphur. dil., ʒ ij; aquæ, ℥ iv. M. Sig. *A tablespoonful in a wineglassful of water each morning before breakfast.* For *habitual constipation* in those of full habit and active circulation, a daily morning dose of a teaspoonful of Epsom salts is often a permanently effective remedy.

The disagreeable taste of Epsom salts is perfectly well covered by coffee. Boil for two minutes in an earthen vessel one ounce of sulphate of magnesia, two and a half drachms of roasted coffee in a pint of water; then remove from the fire, allow it to "draw" for a few minutes and strain.

The other saline purgatives belonging to this group are:

Sodii Sulphas, sulphate of sodium, Glauber's salts,

Potassii Sulphas, sulphate of potassium; but both of these have long since ceased to be used.

Sodii Phosphas, phosphate of soda,

Potassii et Sodii Tartras, tartrate of potassium and sodium, Rochelle salts, and

Pulveres Effervescentes Aperientes, effervescing aperient powders or Seidlitz powders, have been considered elsewhere.

Potassii Bitratras, bitartrate of potassium, cremor tartar, may also be regarded as a member of this group, although it has but feeble purgative property.

Mercurial Purgatives.—As the actions and uses of the mercurial preparations have been sufficiently discussed elsewhere, little need be said in addition as respects their applications as purgatives.

Hydrargyri Chloridum Mite.—Mild chloride of mercury. Calomel. Dose as a cathartic, gr. j—grs. x.

Pilulæ Hydrargyri.—Mercurial pill. Blue mass. Dose, grs. v—grs. xv, as a cathartic.

Actions and Uses.—These mercurial purgatives are rather slow in their action. A dose at bedtime will usually operate during the course of the following morning. One grain of calomel or five grains of mercurial pill will produce distinct purgative effects in most persons in about twelve hours, unless there be considerable habitual torpor of the bowels. They are apt to cause griping pains, nausea, and even vomiting, when the purgative effects begin. First brownish and bad-smelling, and afterward greenish stools, supposed formerly to be characteristic of the mercurial action, are produced. Much heated discussion has arisen as to the cholagogue action of mercury. Without entering into details on this point, it may be admitted that bile-elements are found in the stools from the action of mercury, as they are unquestionably found in the stools caused by some other purgatives. The presence of bile-elements in the fæces discharged only proves that mercurial cathartics swept them out with the other contents of the intestinal canal, and does not prove that an excitant action was exerted on the secretory function of the liver. The stored-up bile in the gall-bladder may be emptied into the intestine in obedience to a reflex influence transmitted from the intestinal mucous membrane irritated by the purgative. Experimental investigations must be invoked to determine the question whether mercurials actually stimulate the liver to the production of an increased quantity of bile. In another place the experiments of Hughes Bennett's Edinburgh Committee have been stated. As these pages are going through the press, the very accurate and painstaking investigations of Rutherford and Vignal are being published. Röhrig had already determined as the result of his experiments that "with large doses (twenty grains for a dog) it rarely happened that the secretion of bile was recalled after it had come to a standstill, although this agent can increase the secretion when it is only diminishing." Rutherford and Vignal arrived at the following conclusions as the results of their experiments with calomel: "1. An increase of the biliary secretion followed the administration of two successive doses of ten grains of calomel in one case (Experiment 30). Diminution of the secretion was the only result of the same doses given under similar circumstances in other two cases (Experiments 31 and 32); and it was the most definite result of the administration of four successive doses of three grains in another case (Experiment 33). 2. In all the four experiments the calomel had a purgative effect. 3. Analysis of the bile secreted during the calomel purgation in Experiment 33 showed that, notwithstanding a diminution in the quantity of bile secreted, the percentage amount of solids had become less." The results of experiment render it probable that mercurials do not increase the secretion of bile.

That the purgative action of mercurials has a distinctive and peculiar quality, a vast clinical experience attests. The stools are rather different from those caused by other purgatives, and the therapeutical effects are, it is generally held, *sui generis*. Whatever peculiarity pertains to the purgative action of mercurials is probably due to the fact that they greatly increase the elimination of the products of waste, or retrograde metamorphosis of tissue, by the intestinal glandular apparatus.

As a purgative the use of mercury is restricted to those cases in which a deficiency of bile is supposed to be the cause of the morbid state—*clay-colored stools*, *jaundice from catarrh of the gall-ducts*, and to those cases, singularly enough, in which bile is supposed to be in excess—*biliousness*, so called, jaundice from excessive production of bile, etc. For further remarks on the actions and uses of mercury the reader is referred to the section on remedies used to promote destructive metamorphosis.

TONIC-ASTRINGENT AND RESIN-BEARING PURGATIVES.

Senna.—Senna. *Feuilles de séné*, Fr.; *Sennesblätter*, Ger. "The leaflets of cassia acutifolia, of cassia obovata, and of cassia elongata."

Confectio Sennæ.—Confection of senna. (Senna, coriander-seed, liquorice, figs, prunes, tamarinds, cassia.) Dose, ʒ j—ʒ ij.

Extractum Sennæ Fluidum.—Fluid extract of senna. Dose, ℥ ss.

Infusum Sennæ.—Infusion of senna. (Senna, ℥ j; coriander-seed, ʒ j; boiling water, Oj.) Dose, ℥ iv.

COMPOSITION.—The active constituents of senna prove to be a peculiar colloid body, and an acid, to which has been given the name *cathartic acid.* It has been shown that "*cathartate of ammonia* possesses, in a concentrated form, the purgative activity of the original drug." Two bitter principles have been obtained from senna—*sennacrol* and *sennapicrine.* It contains also a peculiar sugar—*cathartomannite.*

ACTIONS AND USES.—The taste of senna is nauseous and bitter. In infusion—the form in which it is most usually prescribed—it is most disagreeable in odor as well as taste. It produces a sense of warmth in the stomach, and causes much flatulence and griping, which may, however, be prevented by combination with aromatics. Its active principles are absorbed, and the milk of the mother taking senna acquires a purgative property. It is a very efficient cathartic, producing copious liquid stools in about four hours. It does not cause inflammation or hypercatharsis, and its purgative action is not followed by intestinal torpor and constipation. It is, therefore, a very safe and serviceable cathartic, if it were not so disagreeable.

The confection of senna is a palatable preparation, and a mild laxative, operating without any disturbance. It is used chiefly to correct the *constipation of pregnancy*, but it is highly prized by some patients as a remedy for *habitual constipation.* It is also taken to procure soft and easy evacuations in *hæmorrhoids*, *fissures of the anus*, etc. A large bolus (one hundred and twenty grains), taken at bedtime, will operate gently on the following morning. The fluid extract of senna is a form for the administration of this drug more agreeable than the infusion. These two preparations are very excellent cathartics to overcome constipation, especially when ordinary purgatives fail.

The action of senna is much improved by combination with other purgatives, and with aromatics. The well-known "black draught" is an infusion of senna with sulphate of magnesia—one ounce of the latter dissolved in four ounces of the former. By the addition of coffee, the odor and flavor of senna may be rendered more tolerable. Two drachms of senna and one drachm of coffee may be infused in three ounces each of hot milk and boiling water, and the whole drunk after twelve hours.

Rheum.—Rhubarb. *Rhubarbe*, Fr.; *Rhabarber*, Ger. "The root of rheum palmatum, and of other species of rheum."

Extractum Rhei.—Extract of rhubarb. Dose, grs. x—grs. xv.

Extractum Rhei Fluidum.—Fluid extract of rhubarb. Dose, ʒ ss—ʒ ij.

Infusum Rhei.—Infusion of rhubarb. Dose, ℥ ss—℥ ij.

Pilulæ Rhei.—Rhubarb-pills. Each pill contains three grains of rhubarb and one grain of soap.

Pilulæ Rhei Compositæ.—Compound pills of rhubarb. (Rhubarb, socotrine aloes, myrrh.) Dose, 2—4 pills.

Syrupus Rhei.—Sirup of rhubarb. (Fluid extract, ℥ iij; simple sirup, ℥ xxix.) Dose, ʒ ss—ʒ ij.

Syrupus Rhei Aromaticus.—Aromatic sirup of rhubarb. (Rhubarb, cloves, cinnamon, nutmeg.) Dose, ʒ ss—ʒ ij.

Tinctura Rhei.—Tincture of rhubarb. Dose, ʒ j—℥ ss.

Tinctura Rhei et Sennæ.—Tincture of rhubarb and senna. Warner's gout cordial. Dose, ℥ ss—℥ ij.

Vinum Rhei.—Wine of rhubarb. (Rhubarb, canella, sherry.) Dose, ʒ j—℥ ss.

COMPOSITION.—Rhubarb contains a number of substances which have been isolated, but its composition has not yet been accurately determined. It contains two acids, *rheo-tannic* and *rheumic*, a resinous body, *phæoretine*, and *chrysophan*, or *chrysophanic acid.*

PHYSIOLOGICAL ACTIONS.—In small doses, rhubarb is a tonic astringent. It promotes the appetite and the digestive power, and, by virtue of its tannin, is astringent and diminishes peristalsis. As it contains also a purgative principle, in sufficient doses cathartic effects follow its administration. The stools are stained by the coloring-matters of the rhubarb, are of a yellowish-brown color, and are rather soft without being watery. After the purgative action has ended, the astringent constituents assert their power and constipation results. As the stools present an appearance to which the term "bilious" was applied, it was formerly supposed that rhubarb had the power to increase the flow of bile; more recently it has been universally conceded that the coloring-matter of rhubarb produces the peculiar tint referred to. The latest investigations of Rutherford and Vignal have, apparently, very conclusively shown that rhubarb really possesses the property anciently ascribed to it, and that it must be placed among the cholagogue medicines. As it is now known to increase the flow of bile, it may be assumed that the intestinal secretions in general are promoted by it. These effects, which indeed are produced by all the purgatives containing a resin, are probably due to phæoretine—the rhubarb resin.

The coloring-matters of rhubarb stain the perspiration, milk, and urine, and the milk acquires a bitter taste and purgative properties.

THERAPY.—The infusion of rhubarb is frequently employed as a vehicle for the administration of alkalies and mineral acids, in *stomachic disorders.* In small doses, the tincture is an excellent *stomachic tonic* in *dyspepsia*, with deficient biliary and intestinal secretions. It is adapted to those of a relaxed habit, and is inadmissible when an hyperæmia of the mucous membrane exists.

Rhubarb is a remedy of the greatest utility in the *duodenal catarrh*, and in the *catarrh of the biliary ducts with jaundice*, as these maladies occur in children. The passing of whitish, pasty, or clay-colored stools, while the skin presents an earthy or jaundiced hue, is the indication for the use of rhubarb. It is true that the stools will be quickly stained, so as to present the bilious character, without any improvement having necessarily taken place in the local malady; but it is also true that rhubarb is curative in the conditions above described. In the *summer diarrhœa* of children, no remedy is more generally prescribed. The aromatic sirup of rhubarb is a pleasant form in which to administer it. In this disorder, especially if the motions are sour, alkalies should be prescribed with the rhubarb. Magnesia, chalk, or sodium carbonate, may be given with the powder of rhubarb, the fluid extract, or the sirup. The following is an excellent formula in these cases: ℞. Infus. rhei, ℥ iij; potassii bicarb., ʒ j; tinct. cinnamomi, ʒ ij; syrp. simplicis, ʒ vj. M. Sig. *A teaspoonful every hour or two in cholera infantum. Diarrhœa* in children or adults, due to the presence of undigested food, or retained irritating secretions, may not unfrequently be cured by a purgative dose of some rhubarb preparation. After the purgative effect is expended, the bowels are confined by the astringent. In acute dysentery the saline purgatives are much more appropriate than rhubarb.

In *habitual constipation* good effects may be obtained by chewing some rhubarb-root. The astringent after-effect is, however, a decided objection to the frequent use of this remedy for this purpose. In the rhubarb-pill the astringency is counteracted by soap. The compound rhubarb-pill, which contains aloes, is a mild and efficient cathartic.

Aloes.—*Aloe Barbadensis.*—Barbadoes aloes. The inspissated juice of the leaves of aloe vulgaris.

Aloe Capensis.—Cape aloes. The inspissated juice of the leaves of aloe spicata, and of other species of aloe.

Aloe Socotrina.—Socotrine aloes. The inspissated juice of the leaves of aloe socotrina.

Aloe Purificata.—Purified aloes. "In brittle pieces of a dull-brown or reddish-brown color, and having the peculiar aromatic odor of Socotrine aloes. It is almost entirely soluble in alcohol." Dose, gr. j—grs. v.

Pilulæ Aloës.—Pills of aloes. Each pill contains two grains of aloes, and two grains of soap. Dose, 1—5 pills.

Pilulæ Aloës et Asafœtidæ.—Pills of aloes and asafœtidæ. (Aloes, asafœtida, and soap, in equal parts.) Dose, 2—5 pills.

Pilulæ Aloës et Mastiches.—Pills of aloes and mastic. Lady Webster's pills. (Aloes, mastic, and red rose.) Dose, 1—2 pills.

Pilulæ Aloës et Myrrhæ.—Pills of aloes and myrrh. (Aromatic powder, myrrh, aloes.) Dose, grs. v—grs. xv.

Tinctura Aloës.—Tincture of aloes. Dose, ʒ ss—℥ j.

Tinctura Aloës et Myrrhæ.—Tincture of aloes and myrrh. Dose, ʒ ss—ʒ ij.

Vinum Aloës.—Wine of aloes. Dose, ʒ j—℥ ss.

Pulvis Aloës et Canellæ.—Powder of aloes and canella (hiera picra). Dose, grs. v—℈ j.

COMPOSITION.—The odor of aloes is due to a peculiar *volatile oil.* It contains also a *resin*, and a principle, *aloïne.* The composition of aloïne is not precisely the same in the different varieties of aloes. The Barbadoes aloes furnishes *barbaloïne*, the Natal aloes, *nataloïne*, and the Socotrine aloes, *socaloïne.* These varieties, it is supposed, constitute an homologous series.

ACTIONS AND USES.—Aloes has a bitter and very disagreeable taste, leaving a rather acrid after-sensation in the fauces. It is a stomachic tonic, and, like bitters in general, it promotes the appetite and digestion. Accordingly, it is much prescribed as a stomachic tonic in cases of *indigestion with torpor of the large intestine.* Irritable or inflammatory states of the stomach mucous membrane contraindicate its employment.

The recent investigations of Rutherford and Vignal have shown that aloes has the power to stimulate the hepatic functions, and to promote the flow of bile. This result is confirmatory of clinical experience. In large doses (twenty grains or more) aloes undoubtedly increases the intestinal secretions generally; but, in the ordinary medicinal laxative dose, the stools are not liquid, and are but little altered in character. The principal effect of aloes is expended on the large intestine, the peristaltic movement of which it increases. Some tormina is experienced when the laxative effect begins, and tenesmus, with heat and irritation of the rectum, is produced when an active purgative dose has been taken. The blood-supply to the pelvic organs is increased by aloes; the menstrual flow becomes more abundant; in the male, erections take place more frequently, and abortion, it is said, may be caused by its incautious administration.

Ten or twelve hours elapse after it has been swallowed, before cathartic effects are produced. The rate at which it moves to affect the intestinal canal is influenced less by the size of the dose than by the condition of the bowels.

The purgative principle of aloes diffuses into the blood. Applied to an exposed surface it is absorbed and purges, and the milk of mothers taking it acquires a purgative action.

Simple *jaundice*, of an atonic kind, may be cured by aloes. No purgative is more efficient in *constipation*, dependent on weakness and impaired contractility of the muscular layer of the large intestine. Jaundice, or at least a bilious state, a coated tongue, foul breath, a tumid abdomen, and an impacted colon, are conditions frequently associated and are readily relieved by aloes. The constipation of *hypochondriasis* and *melancholia* is best overcome by the use of this agent, and, with the removal of the impacted fæces, there is not unfrequently an improvement in the mental state. Aloes is prescribed in *cerebral disorders*, when purgatives are given with a view to a derivative effect.

In *amenorrhœa*, which is dependent on anæmia, aloes is prescribed, with other appropriate remedies, to determine an afflux of blood to the uterine system. *Menorrhagia*, occurring in debilitated and relaxed subjects, is sometimes relieved in the same way. Iron may be associated with aloes in these cases. Congestion of the pelvic viscera is a contraindication to the use of aloes, and the existence of hæmorrhoids, or of a tendency therefor, has heretofore been considered an equally positive contraindication. Fordyce Barker has, however, shown that aloes has a curative power in certain cases of *hæmorrhoids*, and notably those which occur after delivery. The local condition, under these circumstances, is not one of active hyperæmia, but really consists in a sluggish state of the circulation in the inferior hæmorrhoidal veins. It can hardly be doubted that aloes would increase the trouble if prescribed for cases in which there was active congestion of the pelvic viscera. Barker also advocates the use of aloes in non-puerperal *hæmorrhoids*, but the local condition must be suitable for the use of this remedy or the disease will be aggravated. The following are formulæ proposed by Barker: ℞. Pulv. aloës Soc., sapo. Cast., āā ℈j; ext. hyoscyami, ʒ ss; pulv. ipecacuanhæ, grs. v. M. ft. pil. no. xx. Sig. *One pill morning and evening.* "When the hæmorrhoids are associated with an irritable rectum, and with frequent, small, teasing, thin evacuations, Barker substitutes for the hyoscyamus a small quantity of opium, giving also a less quantity of the aloes, as in the following formula:" ℞. Ferri sulph., ℈j; pulv. aloës Soc., extr. opii aq., sapo. Cast., āā grs. x. M. ft. pil. no. xx. Sig. *One pill morning and evening.* Oppolzer also used aloes as a remedy for hæmorrhoids, prescribing, when there was constipation, aloes and quinia, and, when the bowels were not confined, aloes and sulphate of iron.

The action of aloes, as well as of other resin-bearing purgatives, in the condition of anæmia, is promoted by the conjoined use of the bitters, quinia, iron, and tonics generally. Two grains of aloes, taken at bedtime, will cause a satisfactory evacuation on the following day. Combination with soap, as in the officinal pil. aloës, and pil. aloës and asafœtida, diminishes the drastic, while it increases the efficiency of the purgative, action. It is generally better to give aloes by itself, without combination with other cathartics; but its purgative effects may be greatly enhanced by administering a saline laxative six or eight hours after the aloes has been taken.

A *gonorrhœa* may, it is said, be cured by the internal use, three times a day, of a pill containing two or three grains of aloes. *Catarrh of the uterus* has been treated successfully by aloes rectal enemata. The tincture of aloes, diluted to one-half or even more, by water, is a very effective injection in gonorrhœa after the acute symptoms have subsided.

Jalapa.—Jalap. "The tuber of exogonium purga, or ipomea jalapa." *Racine de jalap*, Fr.; *Jalape*, Ger.

Extractum Jalapæ.—Extract of jalap. Dose, grs. v—℈j.

Resina Jalapæ.—Resin of jalap. Dose, grs. ij—grs. v.

Tinctura Jalapæ.—Tincture of jalap. Dose, ʒss—ʒij.

Pulvis Jalapæ Compositus.—Compound powder of jalap. (Jalap, one part; bitart. of potassa, two parts.) Dose, gr. x—ʒj.

COMPOSITION.—Jalap contains a *resin*, to which its purgative property is due. The resin consists of two varieties, one soluble, the other insoluble, in ether. The latter has been named *convolvuline*, or *jalapine*, and is the more active purgative of the two. Various secondary products of considerable interest are obtained from the resin, but these possess no special importance from the therapeutical point of view.

PHYSIOLOGICAL ACTIONS.—As a cathartic jalap resembles, but it is much more active than, senna. It is apt to produce nausea, and tormina and tenesmus invariably accompany its purgative action. It usually operates in from two to four hours, but the rate at which it moves to affect the intestinal canal is not influenced by the amount administered. The stools are soft at first, and afterward liquid. Jalap does not produce hæmorrhoids, nor does it cause a tendency to, or increase an existing, menorrhagia. The secretions of the intestinal canal are increased by it, and the recent researches of Rutherford and Vignal have demonstrated that jalapine (convolvuline) excites the flow of bile.

The action of jalap appears to be local. It is true that experiments in support of a contrary opinion have been made; but, in the conclusive test of the intra-venous injection of convulvuline, no purgative action has followed (Husemann).

THERAPY.—The resin of jalap being the active constituent, it should generally be preferred. It has the merit of being almost tasteless, and hence may be given readily to children.

Jalap is an efficient cathartic in the beginning of *fevers, inflammations*, and *acute diseases*, requiring the use of such therapeutic means. Formerly calomel and jalap were much prescribed, but this combination has deservedly fallen into discredit. Occasionally the resin and calomel, in less ponderous doses than formerly given, may be used with advantage as a cathartic: ℞. Resinæ jalapæ, hydrarg. chlor. mit., ext. hyoscyami, āā gr. j. M. ft. pil. no. j. Sig. *Take at bedtime.*

As jalap in sufficient quantity causes free watery evacuations, it is a suitable purgative in *anasarca* and *ascites*. The most generally approved hydragogue purgative, under these circumstances, is the compound jalap-powder. The efficiency of this may be increased by the addition of podophyllum. A teaspoonful of the compound powder, taken in the early morning, will usually produce several very copious, watery stools. Increased urinary discharge also is a not unfrequent result of its action.

Jalap has the power to cause the expulsion of *lumbrici*. As a vermifuge it is not at all equal to the other approved remedies, but it is certainly useful as an adjunct. For example, santonine at night, and the resin of jalap and calomel on the following morning, is an effective method of expelling these parasites.

Jalap is, of course, contraindicated in inflammatory states of the intestinal canal. In overdoses it causes hypercatharsis, and it may excite violent gastro-enteritis and endanger life. With proper attention to the conditions in which it is admissible, and to the dosage, jalap is entirely safe, and is a very certain and efficient cathartic. An excellent vehicle for the administration of the resin of jalap is the sirup of rhubarb. ℞. Resinæ jalapæ, grs. ij—grs. v; syr. rhei aromat., ℥ ss. M. This is especially suitable for children.

Scammonium.—Scammony. "A resinous exudation from the root of convolvulus scammonia." *Scammonée*, Fr.; *Scammonium*, Ger.

Resina Scammonii.—Resin of scammony. Dose, grs. v—grs. x.

Composition.—The activity of scammony, as a cathartic, depends entirely on the *resin* which it contains. As the crude scammony is much adulterated, the resin is alone worthy of confidence.

Actions and Uses.—Scammony corresponds very closely to jalap in the time it requires to cause cathartic action, in the character of the stools produced, and in the kind of irritation which it excites. Scammony is somewhat more drastic than jalap. As it has but little taste, and is at the same time very active, the resin is much prescribed by English practitioners as a cathartic for children. It may be given rubbed up with milk, or with sirup of rhubarb. It is adapted to the same class of cases, and to the relief of the same conditions, as jalap.

Colocynthis.—Colocynth. "The fruit, deprived of its rind, of citrullus colocynthis." *Coloquinte*, Fr.; *Koloquinten*, Ger.

Extractum Colocynthidis.—Extract of colocynth.

Extractum Colocynthidis Compositum.—Compound extract of colocynth. (Extracts of colocynth, scammony, and aloes; cardamoms, soap.) Dose, grs. v—grs. x.

Pilulæ Catharticæ Compositæ.—Compound cathartic pills. (Compound extract of colocynth, extract of jalap, calomel, gamboge.) Dose, 1—3 pills. Each pill contains one grain of calomel.

Composition.—Colocynth contains a bitter principle (*colocynthine*) which is the purgative principle. Colocynthitine is another substance contained in the alcoholic extract. It differs from colocynthine in being soluble in ether, and not in water. As colocynthitine is a tasteless crystalline powder, it is probably devoid of purgative property. Colocynthine is a very powerful cathartic.

ACTIONS AND USES.—Colocynth is a gastro-intestinal irritant. In moderate doses it hastens the peristaltic movements, and increases the intestinal secretions. Its cathartic operation is usually attended with griping, and the stools are fluid. Violent gastro-enteritis may be produced by a large quantity, and numerous fatal cases have been reported from its incautious or criminal administration.

The action of colocynth is not merely local. Applied to the skin of the abdomen it causes intestinal pain, and more frequent alvine discharges.

Colocynth is never administered alone, but usually in combination with other purgatives. The compound extract is a safe, effective, and not unpleasant cathartic for the relief of *constipation*. ℞. Ext. colocynthides comp., ℈j; ext. belladonnæ, ext. physostigmatis, āā grs. v. M. ft. pil. no. x. Sig. *One each night in habitual constipation.* The officinal compound cathartic pill is a most serviceable combination. Instead of calomel the resin of podophyllum may be used in the preparation of this pill, without impairing its utility.

In *cerebral congestion* the preparations of colocynth are used as derivative purgatives. *Hypochondriasis* and *melancholia*, when associated with torpor of the large intestines and fecal accumulations, are benefited by brisk purging with the colocynth preparations, but other drastic purgatives are equally efficient.

Colocynth is inadmissible in inflammatory states of the intestinal canal, and is unsafe during the existence of pregnancy. There is a popular notion, which has led to its use in toxic doses, that colocynth may cause abortion. Any quantity which will affect the gravid womb must be sufficient to endanger life.

Podophyllum.—May-apple. The rhizoma of podophyllum peltatum.

Resina Podophylli.—Resin of podophyllum. Dose, gr. ¼—gr. j.

Extractum Podophylli.—Extract of podophyllum. Dose, grs. v—grs. x.

COMPOSITION.—The medicinal qualities of podophyllum are due to a *resin*, or to two resinous substances, one soluble in alcohol and ether, and the other soluble in alcohol only. Both possess purgative properties. May-apple-root contains the alkaloid *berberina*, which, however, is not peculiar to podophyllum, being found in berberis, hydrastis, and other plants.

Resina podophylli is the preparation entitled "podophylline" by the eclectic practitioners.

ACTIONS AND USES.—The taste of podophyllum is bitter, with an after-sense of acridity. It increases the intestinal secretions and is actively cathartic, producing copious and rather watery stools. Its action is similar to, but considerably slower than, that of jalap. From six to ten hours elapse after its administration before cathartic effects are experienced. Taken by itself it is apt to cause nausea and griping, but in combination with other cathartics, or with belladonna or hyoscyamus, it operates pleasantly as well as efficiently. The Edinburgh committee, Dr. Bennett, chairman, ascertained, as they supposed, that the resin of podophyllum has no cholagogue action, but the more recent as well as the more accurately conducted experiments of Rutherford and Vignal have apparently demonstrated that it decidedly increases the flow of bile, corresponding in this particular to the other resinous cathartics.

Podophyllum-resin is the most generally useful cathartic in cases of *constipation*, in which the secretions of the glandular apparatus of the intestinal canal, and of the liver, are deficient. *Habitual constipation*, due to torpor of the muscular layer of the bowel, may, it is said, be removed by the nightly use of a small dose of the resin combined with belladonna. ℞. Resinæ podophylli, grs. vj; ext. belladonnæ, ext. physostigmatis, āā grs. iij. M. ft. pil. no. xij. Sig. *One pill each night.* It is especially in *congestion of the portal circulation*, in *catarrhal* and *malarial jaundice*, and in *ascites*, that podophyllum-resin acts most efficiently and serviceably. *Hæmorrhoids* that bleed in consequence of stasis in the portal circulation, and that are of recent formation, may sometimes be cured by a brisk podophyllum cathartic.

The clinical experience which had shown that the resin of podophyllum possessed cholagogue powers, long before the experimental inquiry was instituted to settle the question, led also to a wide generalization in the therapeutical uses of this agent. Acting on the liver, it was assumed that, in a manner similar to mercury, it must also possess similar "alterative" powers. It came to be used as the "vegetable calomel," in the diseases in the treatment of which mercury was supposed to be essential. It need hardly be asserted that these speculations have no basis, and that podophyllum possesses no property in common with mercury except its power to purge.

Leptandra.—Leptandra. "The root of leptandra Virginica."

There is no officinal preparation. A fluid extract is found in the shops, which may be given in the dose of twenty minims to a drachm. *Leptandrine*, so called by the eclectics, is an impure resin obtained by precipitation from the tincture by the addition of water. The dose of this preparation is two to four grains.

Composition.—A crystallizable principle has been obtained from the root—*leptandria* (?). It contains also a *resin* which, in the impure form at present found in commerce, has a distinctly purgative quality.

Actions and Uses.—Leptandra is an active cathartic in the recent state. In the form of the fluid extract, or of the so-called leptandrine, it acts mildly, causing somewhat liquid and apparently bilious stools. It is held to be cholagogue, and, according to the rules of analogy, this claim may be well founded, for other cathartics containing resin, as the experiments of Rutherford and Vignal have shown, possess the power to increase the flow of bile.

It is applicable to cases of disease of the intestinal canal, attended by constipation, in which the biliary and intestinal secretions are insufficient.

Iris Versicolor.—Blue flag. "The rhizoma of iris versicolor."

There are no officinal preparations of this drug. A fluid extract is prepared, the dose of which is from twenty minims to a drachm. The so-called *iridine*, an impure oleo-resin, is given in the dose of one grain to five.

ACTIONS AND USES.—Iris versicolor has a bitter, nauseous, and rather acrid taste. It is apt to cause severe nausea. The fresh root has actively purgative and diuretic qualities, but these are impaired by age. The fluid extract and the "iridin" are laxative, and are supposed to have cholagogue powers.

The oleo-resin is prescribed in *hepatic* and *intestinal disorders*, and in *dropsy*. There is much evidence tending to show that this remedy is really serviceable when the stools are clay-colored, and the skin jaundiced, in consequence of duodenal catarrh and obstruction of the biliary ducts. It is said that *malarial jaundice* may be cured by this drug, and that in *bilious remittent fever* and in *chronic malarial poisoning* it exerts a favorable influence.

Euonymus.—Wahoo. "The bark of euonymus atropurpureus."

There are no preparations recognized by the United States Pharmacopœia. A fluid extract is prepared for sale, the dose of which is twenty minims to a drachm. The eclectic preparation (euonymin) consists of the resin and fixed oil, and is prescribed in the dose of a half-grain to five grains.

COMPOSITION.—An uncrystallizable and intensely bitter principle has been isolated (*euonymine*). It contains also a crystallizable, a yellow and a brown resin, fixed oil, etc.

ACTIONS AND USES.—Euonymus possesses cathartic properties similar to rhubarb, and is an excellent remedy in hepatic and intestinal disorders requiring the use of such a remedy. The eclectic preparation (euonymin) is a convenient form in which to procure the cathartic action of euonymus.

HYDRAGOGUE CATHARTICS.

Gambogia.—Gamboge. *Gumme gutte*, Fr.; *Gummigutt*, Ger. A gum-resin obtained from the garcinia morella (F. and H.). Dose, gr. j

The only officinal preparation is the compound cathartic pill, of which gamboge constitutes about a tenth part.

Composition.—Gamboge is a mixture of resin and gum, the latter constituting from fifteen to twenty per cent.

Actions and Uses.—Gamboge has no taste at first, but, when chewed, an acrid sensation is developed in the mouth. It is irritant to the gastro-intestinal canal, increases secretion of the glands, excites vomiting and intestinal pain, and purges violently, producing copious watery stools. The experiments of Rutherford and Vignal show that gamboge is not an hepatic stimulant, but does cause hydrocatharsis. Violent gastro-enteritis is set up by large doses, yet but few fatal cases have been reported. As vomiting soon follows the ingestion of a large dose, this fact may explain the rarity of a fatal result due to its administration.

Gamboge is rarely prescribed alone as a cathartic, owing to the violence and harshness of its operation. Combination with other cathartics, as in the compound cathartic pill, greatly modifies its action. As it is a powerful hydragogue cathartic, it is given with advantage in *dropsy*, when hydrocatharsis is indicated. It is best administered in small doses, at short intervals, rubbed up with sugar or made into a pill with soap. Besides its purgative properties, gamboge is decidedly *diuretic*. In order to obtain its diuretic effects it must be given in small doses, at short intervals, and vomiting must be avoided. Administered in solution with an alkaline diuretic, its efficiency is much increased. Gamboge has also been used as an *anthelmintic*, but it has no powers in this respect not possessed by other drastic purgatives.

Oleum Tiglii.—Croton-oil. "The fixed oil obtained from the seeds of croton tiglium." *Huile de Croton*, Fr.; *Crotonöl*, Ger. Dose, gt. j—gtt. ij.

Composition.—It contains glycerides of the fatty acid series—stearic, palmitic, myristic, and lauric acids—and the more volatile acids acetic, butyric, and valerianic (Flückiger and Hanbury, Husemann). Genther and Fröhlic have discovered a peculiar volatile acid to which they have applied the name *tiglinic acid.* By the same chemists the so-called *crotonic acid* is held to be an artificial product. Schlippe has asserted the discovery of the vesicating principle of croton-oil, but other chemists have failed to find this substance, to which he has assigned the name *crotonol.* The purgative principle of the oil appears to exist in all parts of the croton tiglium, but it has not yet been isolated.

Actions and Uses.—Croton-oil is a transparent or semitransparent viscid liquid, amber-colored, and having a rather rancid smell, and an oily, acrid taste. Applied by friction to the skin it excites inflammation, and causes an eruption which is at first papular, with rounded summits, and afterward becoming pustular. The eruption is sometimes umbilicated, but is generally rounded. An areola surrounds the pustules, and there are considerable heat and burning in the part. The eruption appears in a few hours after the frictions have been practised, reaches its maximum in about four days, and then declines by abortion of the pustules and by scabbing. In many subjects permanent, small white cicatrices mark the site of the eruption. All subjects are not equally susceptible to the vesicating action of croton-oil.

The mucous membrane is violently attacked by croton-oil. In the fauces it causes an intensely acrid sensation, and increases the flow of saliva. A sense of heat, pain, and nausea, are produced when the oil is received into the stomach, tormina soon follows, and in an hour or two watery stools are passed with some burning and irritation about the anus. The action of the oil continues during the succeeding twelve to twenty-four hours, numerous fluid dejections are passed, and considerable debility is the result. When large doses are taken, if not rejected promptly by vomiting, violent hypercatharsis occurs, with great prostration and collapse. Fortunately, when an overdose is swallowed, vomiting quickly ensues, and hence very large quantities have been taken without producing a fatal result. The lesions caused by croton-oil are those of gastro-enteritis, but fatal cases have occurred, with all the objective phenomena of choleraic collapse, without any evidences of local inflammation.

As croton-oil is still purgative after being deprived of its acrid principle by washing with alcohol, it has been held that the oil becomes cathartic only by the action of the alkaline juices of the duodenum. Numerous instances have been reported, and some have fallen under the author's observation, in which croton-oil applied to the integument has produced diarrhœa. It must, therefore, act by absorption into the blood. In some cases, without causing purging, croton-oil affects the nervous system in a peculiar manner. Thus restlessness, palpitation of the heart, headache, giddiness, confusion of ideas, etc., have occurred under these circumstances (Husemann).

Röhrig found that croton-oil stimulated the hepatic function, and increased the flow of bile. Radziejewski found peptones, bile, glycogen, leucine, and tyrosine, in the stools. Rutherford and Vignal have since shown that croton-oil, although it causes great vascular dilatation of the vessels of the intestinal mucous membrane, cannot be regarded as a cholagogue.

The principal effect of croton-oil, for which it is administered in medical practice, is that of a *hydragogue cathartic.* It is, therefore, used in *dropsies* when it is desired to procure free watery evacuations. It is inadmissible when there is much debility, or when an irritable or inflammatory state of the intestinal mucous membrane exists.

Notwithstanding its great activity, croton-oil is an easily-managed cathartic for ordinary purposes. It is the most efficient purgative when there is simple *impaction*, without inflammatory symptoms. The *constipation from lead* may be overcome by it, when less powerful purgatives will fail. It is the most appropriate of cathartics, when these agents are indicated as *revulsives in cerebral congestion.* Croton-oil, by increasing the vascular dilatation in the intestines, lowers the intracranial blood-pressure. *Per contra,* it is harmful when a state of cerebral anæmia exists.

Croton-oil has been used successfully against *tænia,* but it has no special vermifuge property.

The smallness of the dose required renders croton-oil a very useful purgative in the maladies of children and of the insane. When the patient is unable to swallow from insensibility or paralysis, a drop or two placed on the tongue will act efficiently. It may be given to children, rubbed up with sugar of milk. As washing with alcohol removes the acridity, and does not impair the purgative property, a preparation so treated will be best for administration to children. The unpleasant effects of this remedy may be much modified by combination with other cathartics: ℞. Ol. tiglii, gtt. iij; ext. colocynth. comp., ℈j; ext. belladonnæ, grs. iij. M. ft. pil. no. vj. One of these will usually act efficiently. The following is the formula of Dr. Francis's "triplex pills:" ℞. Aloes Socot., scammonii, pil. hydrargyri, āā ℥j; ol. tiglii, m. xx; ol. carui, m. xc; elix. proprietatis, q. s. M. ft. pil. no. 400. *Dose, as a laxative, one at bedtime.*

Elaterium.—Elaterium. "A substance deposited by the juice of the fruit of momordica elaterium, ecbalium agreste." *Concombre purgatif,* Fr.; *Springgurke,* Ger. Dose, gr. $\frac{1}{16}$—gr. $\frac{1}{4}$.

Composition.—The important constituent of elaterium is *elaterine.* This principle crystallizes in hexagonal plates or prisms. In taste it is acrid and bitter.

Elaterine.—Dose, gr. $\frac{1}{16}$ in pill.

Actions and Uses.—Elaterium excites an abundant flow of saliva, and a persistent bitter taste is experienced in the fauces some time after it is swallowed. Nausea and vomiting, profuse, watery stools, and great weakness and prostration are produced by a considerable dose of elaterium. The vomited matters and stools have an appearance and composition similar to the "rice-water" discharges of cholera. On animals elaterium acts somewhat differently. Without causing purging it affects the nervous system, producing irregular respiration, hebetude, convulsions, and death (Köhler). The gastro-intestinal action is doubtless local, and the result of the immediate impression made by the agent in its passage down the intestinal canal. According to Köhler, the presence of bile is necessary to the action of elaterium.

The chief use of elaterium is to procure free watery evacuations in *ascites, general dropsy, uræmia,* and to act as a revulsive in *cerebral disorders.* It must be used with caution in debilitated subjects. Gastro-intestinal irritation, or inflammation, contraindicates its use. The depression which its operation induces must be counteracted by stimulants and proper aliment.

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Enemata.—An *enema* is a rectal injection. The capacity of the rectum, it need hardly be stated, varies with the age of the individual. For an infant, half an ounce to an ounce; for a child of two to five years, two to six ounces; for five to fifteen years, six ounces to a pint; for an adult, a pint to a quart of fluid may be considered as an approximation to the capacity of the rectum at these ages respectively. Habitual use of injections no doubt increases the tolerance, as also the capacity of the rectum.

Injections may consist of water—cold, tepid, warm, or hot; of medicated solutions—emollient, anodyne, laxative, cathartic, or anthelmintic. Under this head are to be considered only enemata administered with the view to cause an evacuation from the intestinal canal.

Enemata act either by a reflex irritation or by absorption. When a cold injection is thrown into the rectum, or this organ is distended, an action is set up for the expulsion of the offending substance, and the muscular fibre of the bowel more or less vigorously contracts according to its functional condition. The quantity, as well as the temperature of the fluid injected, must therefore be taken into consideration, when it is proposed to empty the bowels by a merely reflex irritation. On the other hand, when it is the intention to procure the absorption of the medicated fluid, the quantity injected must be relatively small, and its temperature should as nearly as possible be that of the rectum. In order to secure absorption, it is necessary also to regard the laws of osmosis. As the secretions of the rectum are alkaline, it is obvious that acidulated solutions will diffuse into the rectal veins with the greatest facility. It is doubtful whether colloidal substances of themselves are taken up in the rectum. (*See* NUTRIENT ENEMATA, p. 42.)

Irrigation of the intestines, or *forced injections* of a large quantity of water, is a modern expedient of great practical utility. The apparatus required for the performance of this operation consists of a rectal tube, a flexible rubber pipe three or four feet in length, and a funnel-shaped vessel to contain the fluid to be injected. The decubitus on either side, the hips being elevated, may be sufficient; but, to insure gravitation of the fluid to the ileo-cæcal valve, the female patient should be placed in Sims's position, and the male patient on his hands and knees. The rectal tube should be inserted, and passed up to the sigmoid flexure; the flexible tube should then be attached. The height to which the reservoir is raised will regulate the hydrostatic pressure, and the flow of fluid through the flexible tube can be lessened or increased at the pleasure of the operator by compression with the fingers.

In administering rectal injections the utmost gentleness is requisite, especially when a large amount of fluid is to be introduced. Rude thrusting of the pipe into the rectum may injure the mucous membrane, and rapid and forcible dilatation of the bowel will excite an imperious desire to go to stool. Too great pressure, in the process of irrigation, may cause a rupture of the intestine, especially if its coats are softened by disease or penetrated by ulceration. It is possible that sudden and forcible distention of the bowel may produce dangerous cardiac syncope in susceptible subjects.

The experiments on the cadaver have demonstrated that, although the large intestine may be filled with water, no fluid can be made to pass the ileo-cæcal valve. Notwithstanding these experiments, it has been claimed that in the living subject, by the irrigation method, water can be forced through the whole length of the intestine. If these observations are correct, it is probable that a pathological state of the ileo-cæcal valve must have existed.

FORMS OF ENEMATA.—*Enema Aloës.*—℞. Aloës, ℈ij; potassii carbonat., grs. xv; mucil. amyli *vel* decoct. hordei, ℥ x. (B. P.)

Enema Magnesii Sulphatis.—℞. Magnesii sulphat., ℥ j; ol. olivæ, ℥ j; mucil. amyli *vel* decoct. hordei, ℥ xv. Dissolve the sulphate of magnesia in the mucilage, then add the oil. (B. P.)

Enema Terebinthinæ.—℞. Ol. terebinthinæ, ℥ j; mucil. amyli *vel* decoct. hordei, ℥ xv. (B. P.)

Enema Ol. Ricini et Terebinthinæ.—℞. Ol. terebinthini, ℥ ss; ol. ricini, ℥ iss; ovi, j; decoct. hordei *vel* aq. fervid., ℥ xiv.

A common domestic enema consists of soap-suds, made somewhat more stimulating to the rectum by the addition of common salt.

THERAPY.—A pint of cold water is a good enema for cases of habitual constipation, especially when there are hæmorrhoids which bleed with every motion. The enema of aloes, in quantity corresponding to the age of the subject, is an efficient remedy for the destruction of *ascarides vermiculares.*

The purgative enemata above given are employed to act on the large intestine, chiefly by virtue of reflex stimulation, but, in part, absorption of the purgative principle takes place, whence it follows that they may affect the whole canal. They are used, therefore, as cathartics, and for the ordinary purposes of these remedies. The purgative enemata are not suitable for habitual use. They excite irritation of the rectum, which may result in ulceration, ischio-rectal abscess, *fistula in ano*, fissure of the anus, and other serious accidents.

Irrigation of the bowel is resorted to for the removal of *impacted fæces*, to overcome *intussusception*, etc.

Cases of intestinal invagination have been very quickly relieved by sudden inflation of the large intestine with carbonic acid. The process consists in the injection of a solution of sodium bicarbonate, followed by a solution of tartaric acid—about one drachm of each to eight ounces of water. The escape of the gas through the *sphincter ani* must be prevented by forcible pressure upon the anus.

Suppositoria Aloës.—(Aloes and cacao-butter.) Each suppository contains about five grains of purified aloes. One of these, introduced into the rectum at night, will generally procure one or two evacuations on the following day. It is not good practice to employ such a method of treatment frequently.

A piece of hard white soap cut into a conical shape, and of a suitable size, is frequently used in domestic practice to relieve the *constipation of infants.* The soap suppository thus prepared is carefully introduced into the rectum. The habit of a daily evacuation may be thus induced. A piece of paper rolled into a conical shape, and dipped into oil, may be used instead of the soap suppository.

ANTHELMINTICS.

ANTHELMINTICS are remedial agents used to cause the expulsion of parasites from the intestinal canal. *Vermifuges* are remedies which expel worms; *vermicides* are remedies which kill as well as expel worms. Some of these agents act mechanically, as mucuna and powdered tin; others are administered in such quantity as to sicken and disable the worms, when their expulsion is easily effected: for example, pumpkin-seed emulsion; others again possess narcotic and toxic properties, as turpentine, chenopodium, santonine, etc.

Anthelmintics are conveniently divided into those employed against ascarides vermiculares, those employed against ascarides lumbricoides, and those employed against the different varieties of tænia.

Ascarides vermiculares infest the rectum and large intestine, extending up occasionally as high as the ileo-cæcal valve; in females, they may also spread into the vagina. As they deposit their ova in the folds of the anus, and in the vagina, it is obvious that the parasiticide, to be effective, must be applied in these situations.

Infusion of quassia, decoction of aloes, and a weak solution of carbolic acid, are the most frequently-prescribed remedies for the destruction of ascarides. If carbolic acid is used, the strength of the injection for children should not exceed twenty grains to the pint. Infusion of quassia is at the same time safe and effective; but, when this injection is used, a solution of carbolic acid should be applied also, by means of a sponge, to the folds of the anus, and, in the case of female children, to the external genitals. If the ascarides extend up into the large intestine beyond the sigmoid flexure, a dose of santonine and calomel should precede the use of the rectal parasiticide.

REMEDIES USED FOR THE EXPULSION OF ASCARIDES LUMBRICOIDES.

Mucuna.—Cowhage. The hairs of the pods of mucuna pruriens. (United States Pharmacopœia secondary list.) This remedy is now rarely if ever used. It is administered in the form of electuary, mixed with molasses. A teaspoonful or more of the mixture should be administered fasting, and after the action of a cathartic. When several doses have been taken a brisk purgative should be given.

When cowhage is applied to the skin it excites intense itching, inflammation in the skin, and pustulation. It has been proposed as a counter-irritant, but a more disagreeable one could hardly be conceived. It is very irritant to the intestinal mucous membrane, as it is to the skin, and an action is speedily set up for its expulsion. When by the use of a purgative, and by reason of fasting, intestinal worms are uncovered and exposed to attack, it is held that the mucuna-hairs pierce the parasites and irritate them, so that their stay in the intestine is rendered intolerable. In consequence of the active peristaltic movements induced by the cowhage, and by the purgative with which it is followed, the worms are hurried out with the remaining contents, if any, of the intestines.

Santonica.—Santonica. The unexpanded flowers of artemisia cina. *Semencine*, Fr.; *Wurmsamen*, Ger.

COMPOSITION.—Resin, malic acid, essential oil, and a crystallizable principle (*santonine*).

Santoninum.—Santonine. "A colorless substance crystallizing in shining, flattened prisms, without smell, and nearly tasteless when first put into the mouth, and afterward bitter. It is not altered by the air, but becomes yellow on exposure to light. Nearly insoluble in cold water, it is dissolved by two hundred and fifty parts of boiling water. It is soluble in forty-three parts of cold, or in three parts of boiling alcohol, and in seventy-five parts of ether." Dose, gr. ss—grs. v, according to age.

Trochisi Santonini.—Troches of santonine. (Santonine, ℥ ss; with sugar, tragacanth, orange-flower water, to form four hundred and eighty troches.) Each troche contains a half-grain of santonine.

Antagonists and Incompatibles.—We do not possess any satisfactory data in regard to the physiological antagonists of santonine. When a poisonous dose has been taken the stomach should be emptied, and the systemic effects should be treated symptomatically.

Synergists.—Therapeutically the action of santonine is aided by cathartics, especially by calomel.

Physiological Actions.—In ordinary medicinal doses as used for the expulsion of lumbrici, santonine causes no sensible intestinal disturbance. In considerable doses nausea and vomiting are produced, and are followed by colic and diarrhœa. Santonine enters the blood, probably, in combination with soda, for, although it has no acid properties, it has the power to form such combinations. Santonine, according to Hesse (Flückiger and Hanbury), is the anhydride of a crystallizable acid, which, when heated, is resolved into santonine and water. Vision is affected in a remarkable manner. Usually all objects appear as if viewed through yellow glass; but other colors sometimes appear, as green, blue, or even red (*Gelbsehen*, Rose). The chromatopsia is probably due, according to Rose, to the solution of santonine in the alkaline serum, and its action on the perceptive centres (vol. xviii., page 26). In passing out with the urine santonine imparts a yellowish, and, when the amount is large, a reddish-purple, hue to this fluid.

In toxic doses santonine produces very decided cerebral effects: trembling, vertigo, convulsive movements, tetanoid cramps, stupor, cold sweats, dilated pupils, insensibility, etc.

Therapy.—Cures of *amaurosis* have been reported from the use of santonine, but we possess no exact indications for its administration. It is, probably, effective only in functional derangement. The chief use of this remedy is for the expulsion of *ascarides lumbricoides.* It is the most effective and pleasant remedy which can be employed for this purpose. A convenient form for administration is the troche, or it may be prescribed in a powder with calomel. The following is a successful plan of using this parasiticide: A laxative in the morning, fasting through the day, a dose of santonine and calomel at bedtime, a senna-draught on the following morning.

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Spigelia.—Pink-root. The root of spigelia Marilandica.

Extractum Spigeliæ Fluidum.—Fluid extract of spigelia. Dose, ʒ j—℥ ss.

Extractum Sennæ et Spigeliæ Fluidum.—Fluid extract of spigelia and senna. Dose, ʒ ij—℥ j.

Infusum Spigeliæ.—Infusion of spigelia. Dose, ℥ ss—℥ ij.

COMPOSITION.—A bitter, uncrystallizable principle (*spigeline?*), volatile oil, tannic and gallic acid.

ACTIONS AND USES.—In moderate doses spigelia produces a sensation of warmth at the epigastrium, stimulates the intestinal movements, accelerates the action of the heart, and promotes the cutaneous transpiration. In large doses it produces cerebral effects, vertigo, dimness of vision, dilated pupils, convulsions, and insensibility. Many of the serious symptoms supposed to have been produced by it in certain cases, were probably really due to preëxisting cerebral lesions. Cases of basilar meningitis, for example, have not unfrequently been confounded with "worm-fever." Any vermifuge, given under these circumstances, might seem to have caused the head-symptoms which are characteristic of the brain-lesions.

Spigelia is used only as a vermifuge, and against the *round worm.* A low diet and a brisk cathartic should precede the use of this remedy. The best form for administration is the fluid extract of senna and spigelia.

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Chenopodium.—Worm-seed. The fruit of chenopodium anthelminticum.

Oleum Chenopodii.—Oil of worm-seed. Dose, gtt. v—gtt. xv.

ACTIONS AND USES.—The oil of worm-seed is the only preparation of the plant now used, and this is rarely employed, in consequence of its very disagreeable and characteristic odor and taste. It excites a sensation of warmth at the epigastrium, increases the action of the heart, and promotes cutaneous, bronchial, and renal secretions. It is a diffusible stimulant, and as such may be given with advantage in *hysteria* and *chorea*, as a carminative in *flatulence*, and as an antiperiodic in *intermittents.* The only use of worm-seed is as a remedy for ascarides lumbricoides. It is one of the most efficient of the class. It should be given three times a day for two days, and followed by a brisk cathartic. An excellent combination for the expulsion of the round worm is ten drops of worm-seed oil, and a teaspoonful of fluid extract of senna and spigelia. It may also be administered in castor-oil.

REMEDIES USED AGAINST TÆNIÆ

The success of tæniafuges depends largely upon the preliminary treatment. The parasite is imbedded in mucus, its hooklets fixed in the mucous membrane. The medicament which is administered for its expulsion must come in contact with the scolex. To dislodge a quantity, however large, of the segments (*strobila*), although temporary relief may follow, will not be permanently curative. The head of the parasite must be expelled.

Before using the tæniafuge the contents of the intestinal canal must be thoroughly evacuated.

Two days of fasting, some milk and bread only being taken, must precede the treatment.

Filix Mas.—Male fern. "The rhizome, covered with portions of the stipes, of aspidium filix mas." *Fougère mâle*, Fr.; *Wurmfarnwurzel*, Ger.

Oleoresina Filicis.—Oleo-resin of fern. Dose, m. xv—ʒ j.

Composition.—A green, fatty oil, volatile oil, resin, tannin, etc. The ethereal extract deposits a granular, crystalline substance (*filicic acid*), on which the medicinal activity of the drug appears to depend.

Actions and Uses.—The oleo-resin of filix mas is a very efficient remedy for tape-worm, especially the unarmed variety; but, if suitable precautions be taken to insure success, it is quite a certain remedy for the armed tænia. The method of Trousseau and Pidoux is as efficient as any (vol. xi., page 1040). On the first day, a strictly milk diet; on the morning of the second day, four grammes (about ʒ j) of the oleoresin, in four doses, with an interval of a quarter of an hour between each; on the third day, the same quantity at the same intervals, followed by fifty grammes of the sirup of ether, and, a half-hour later, an emulsion containing three drops of croton-oil. Küchenmeister gives a number of methods, and Cobbold favors the employment of male fern in certain cases.

Granati Fructus Cortex.—"The rind of the fruit of punica granatum."

Granati Radicis Cortex.—The bark of the root of punica granatum. *Écorce de racine de grenadier*, Fr.; *Granatwurzelrinde*, Ger.

Composition.—Pomegranate-bark contains a large quantity of a peculiar tannic acid (*punico-tannic acid*). There is no constituent which serves to explain its activity as a tæniafuge.

Actions and Uses.—The rind of the fresh root only should be used. The best preparation is the decoction, prepared by boiling gently two ounces of the bark in a quart of water down to a pint. Of this decoction a wineglassful may be given every hour until all is taken. It should be preceded by a brisk purgative, and should be taken fasting. It produces more or less nausea, borborygmi, intestinal pain, and usually purges. If a purgative effect is not caused by it, a brisk cathartic should follow. In the author's experience, this is a very certain and efficient tæniafuge.

Brayera.—Kousso. "The flowers and unripe fruit of brayera anthelmintica." *Brayère anthelminthique*, Fr.; *Kussoblüthen*, Ger.

Composition.—Brayera contains an active principle (*kosine*, or *koussine*), which crystallizes in rhombic prisms. Kosine appears to be inert of itself, and is active only when combined with the other constituents of the drug.

Actions and Uses.—Kousso is used solely as an anthelmintic. Opinions vary as to its utility. On the whole, it may be said that the first enthusiasm which attended its introduction into practice has died away. It brings the segments, but rarely expels the head of the parasite. It is necessary to take it in large quantity—a half an ounce—mixed with water. It is retained with difficulty, and produces much intestinal distress. When successful, the worm is brought away without the action of a purgative.

Rottlera.—Kameela. "The glandular powder and hairs obtained from the capsules of rottlera tinctoria." Dose, ʒ j—ʒ iij.

There are no officinal preparations. A saturated tincture may be given, in the dose of one to three drachms.

Actions and Uses.—It is an orange-powder. It causes some nausea and griping, usually, but it may operate without producing any unpleasant sensations. It acts as a purgative, and causes the expulsion of the worm. If one dose is insufficient, its administration should be continued every three hours until five or six doses have been taken. Kameela is effective not only against tapeworm, but also against lumbrici and ascarides vermiculares.

Pepo.—Pumpkin-seed. "The seed of cucurbito pepo."

Actions and Uses.—This is one of the most efficient remedies which we possess against tænia. Two ounces of the fresh seed are pounded in a mortar, with a half-pint of water, until the husks are loosened and an emulsion is made. The mixture is then strained, and the whole amount is taken fasting. If an action of the bowels does not take place in two hours, the emulsion should be followed by castor-oil. If success is not attained, the dose may be repeated each morning until the parasite is produced. Numerous cases of successful use of pumpkin-seed emulsion have been reported.

The expressed oil, which is bland and unirritating like almond-oil, may be used as a substitute for the seeds. It should be given in the dose of a half-ounce, two or more times, and after several hours followed by castor-oil. The rules already given, in regard to preliminary treatment, should also be followed.

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URINO-GENITAL REMEDIES.

These remedies are employed chiefly for their action on the genito-urinary passages. They stimulate the kidneys to increased activity, and excite the functions of the pelvic viscera. In excessive quantity, or long continued, they may set up inflammation of the kidney, produce strangury and bloody urine, excite uterine contractions, and stimulate to an unnatural degree the sexual propensities. They contain an essential oil, or principle, which makes its exit by the urinary passages and excites local irritation by direct contact.

Oleum Terebinthinæ.—Oil of turpentine. "The volatile oil distilled from the turpentine of pinus palustris, and of other species of pinus." *Essence de têrébinthine*, Fr.; *Terpenthinöl*, Ger. Dose, m. v—℥ ss.

Linimentum Terebinthinæ.—Liniment of turpentine. (Resin cerate, ℥ xij; oil of turpentine, Oss.)

Antagonists and Incompatibles.—All remedies increasing waste, and the vaso-motor depressants, counterbalance the therapeutical actions of turpentine. In cases of poisoning the stomach should be promptly emptied, and anodynes and demulcents should be administered. Elimination should be favored, and the toxic symptoms treated according to the systemic indications. Ozonized oil of turpentine is an antidote to phosphorus, preventing the formation of phosphoric acid and converting the poison into an insoluble spermaceti-like substance. Turpentine worn in a vial about the neck prevents necrosis of the jaw, and steatosis of organs, in workmen engaged in manufactures employing phosphorus.

Synergists.—The diffusible and alcoholic stimulants favor the action of turpentine.

Physiological Actions.—Turpentine-oil is a limpid, colorless fluid, having a strong, peculiar, and diffusive odor, and a hot and pungent taste. It is very slightly soluble in water. The oil exposed to the air absorbs oxygen (ozone), which it retains with great tenacity. Applied to the skin turpentine causes heat, redness followed by a vesicular eruption, and sometimes by intractable ulcerations. A few drops produce a sense of heat at the epigastrium, and a large dose (medicinal) causes intense burning pain, nausea, eructations of the oil, intestinal irritation and purging (usually). Notwithstanding its slight solubility in water, turpentine diffuses into the blood with facility, and is quickly recognized in the breath, sweat, and urine. The action of the heart and arteries is increased by it, the arterial tension rises, and a general sense of warmth and exhilaration is experienced. In large doses (one or two ounces) vomiting, thirst, and a febrile state, are induced ; the muscular strength is diminished, the power of coördination is impaired ; exhilaration of mind, incoherence of ideas, and rambling insensibility, follow. In toxic doses there are complete muscular relaxation and profound insensibility with abolition of all reflex movements ; the face is flushed or cyanosed, the pupils usually dilated, and the breathing labored and stertorous. All the organs by which turpentine is eliminated, especially the kidneys, suffer from extreme irritation when large doses have been swallowed. The skin is usually moist, and exhales a turpentine odor ; the bronchial secretion is increased, and convulsive coughing is induced; the urine is scanty and bloody, and there is violent strangury. The only fatal cases which have been reported have occurred in children (Taylor). From four to six ounces have not destroyed life in adults.

As regards its action on the organs of circulation, the author's experiments show that turpentine stimulates the vaso-motor nervous system when administered in moderate doses. A large quantity quickly exhausts the irritability of the sympathetic ganglia, the action of the heart becomes weak, and the arterial tension falls; the respiratory movements are at first stimulated, but afterward become shallow, and carbonic-acid poisoning supervenes. The brains of animals killed by turpentine smell strongly of it, and hence it may be concluded that it has a direct action on the cells of the cerebral lobes.

Turpentine has decided antiseptic power. It arrests fermentation processes, putrefaction, and is very destructive of minute organisms (vibrio, bacteria, etc.).

The vapor of turpentine inhaled produces nasal and bronchial irritation, frontal headache, and renal irritation, even bloody urine and strangury.

On *post mortem* after turpentine poisoning, violent gastro-intestinal irritation, ecchymoses of the air-passages, congestion of the lungs, and hyperæmia of the kidneys, are noted.

THERAPY.—*Flatulence* may be quickly relieved by a few drops (three to five) of turpentine, on a lump of sugar. This remedy is especially indicated in flatulence persisting from a paretic state of the muscular layer of the bowel. There is abundant evidence to prove the curative power of oil of turpentine in *chronic intestinal catarrh.* It is especially indicated when the tongue is dry and glazed, when there is tympanitic distention of the bowels, and when the alvine discharges consist either of fluid fæces or scybala, mixed with mucus and pale, watery blood. It is best administered in an emulsion, with almond-oil and opium. ℞. Ol. terebinthini, ʒ j; ol. amygdal. express., ℥ ss; tinct. opii, ʒ ij; mucil. acaciæ, ʒ v; aquæ laur.-cerasi, ℥ ss. M. Sig. *A teaspoonful every three, four, or six hours.* The same remedy, in a similar combination, is very effective in acute dysentery after the subsidence of the more acute symptoms. The following is probably the true explanation of its action in these cases: it gives tonicity to the vessels, and to the muscular fibre of the intestines; arrests the putrefactive and fermentative processes which take place in the vitiated mucus and articles of food, and increases the cutaneous capillary circulation, thus relieving congestion of internal organs.

Stimulating enemata are made of turpentine, mucilage, oils, etc. These are especially indicated in constipation, and in impaction of the rectum. ℞. Ol. terebinthini, ʒ ij—℥ j; ol. ricini, ℥ ij; vitell. ovi unius; decoct. hordei, ℥ viij—Oj. M. Sig. *As an enema.* Such injections are frequently used in tympanitic distention of the large intestine, in flatulent colic, in impaction of the cæcum, etc.

A combination of equal parts of turpentine and ether constitutes the well-known remedy of Durand for the solution and cure of *biliary calculi.* Notwithstanding the unquestionable utility of this remedy, we cannot admit with Durand that its efficacy depends on its solvent power (Trousseau). During the attack of biliary colic this remedy may be administered with a view to its anodyne and antispasmodic effect; but, as Köhler states, it is by no means equal to morphia and chloral hydrate. In the after-treatment, clinical experience is in favor of the occasional administration of Durand's remedy during a course of Vichy or Carlsbad water.

Turpentine is one of the most effective remedies which we possess in the treatment of *tæniæ.* Full doses (℥ ss — ℥ ij) are required, and the rules for preliminary treatment already laid down (*see* ANTHELMINTICS) should be adhered to. Turpentine should be combined with a purgative, in order to insure prompt cathartic effect. If absorption of any considerable part of the turpentine takes place, violent intoxication will follow, and irritation of the kidneys, hæmaturia, and strangury, will be produced in the efforts at elimination. The oleo-resin of *filix mas* may be combined with turpentine. ℞. Ol. terebinthinæ, ℥ j; oleoresinæ filicis, ʒ j; vitell. ovi no. ij; ol. ricini, ℥ j. M. Sig. *A draught.* This is an effective, but by no means an agreeable, mixture. An ounce each of turpentine and castor-oil may be administered, as the cathartic, after the use of the decoction of pomegranate.

Turpentine being a cardiac stimulant, and an excitant of the capillary circulation, is contraindicated in hypertrophy of the heart, and when advanced atheroma of the cerebral arteries may be presumed to exist. It is a serviceable *cardiac stimulant* when the action of the heart is weak, and the arterial tension low. In the *passive hæmorrhages* we possess few agents more generally useful. The indications for its use are a condition of debility, relaxation of the vessels, and an impoverished condition of the blood. Transudations of the free mucous surfaces—*epistaxis, bronchial hæmorrhage, hæmatemesis, intestinal hæmorrhage, hæmaturia*—when associated with the state of constitutional depression defined above, are forms of hæmorrhage in which turpentine should be used. ℞. Ol. terebinthinæ, ʒ iij; ext. digitalis fl., ʒ j; mucil. acaciæ, ℥ ss; aquæ menthæ pip., ℥ j. M. Sig. *A teaspoonful every three hours.* The hæmorrhagic transudations which take place in *purpura*, in *scorbutus*, and allied states, are also arrested by turpentine. It need hardly be stated that active hæmorrhage and a condition of plethora contraindicate the use of turpentine.

As a stimulant to the vaso-motor nervous system, turpentine is indicated in *fevers* when the action of the heart is feeble, the arterial tension low, and the peripheral circulation languid. Ten drops in an emulsion is a suitable form, and every two hours is a proper interval for its administration in this condition of things. According to G. B. Wood, a dry tongue, peeling off in flakes, leaving a glazed surface beneath, is a special indication for the use of turpentine in fevers. The intestinal hæmorrhage of typhoid may be restrained by turpentine.

Clinical experience is in favor of the use of turpentine in *puerperal fever*, and in *yellow fever*. The indications for its employment in these maladies are just the same as those mentioned above in typhoid. Cardiac weakness, depression of the vaso-motor nervous system, a dissolved state of the blood, are the conditions requiring turpentine. Tympanitic distention of the abdomen is an additional indication in puerperal fever. Similarly, turpentine is used in *epidemic dysentery, traumatic erysipelas, hospital gangrene*, etc. In these various states, used with a well-defined conception of its real powers, this remedy is more generally serviceable as a stimulant than alcohol. As respects the dosage, in febrile diseases, a rule may be formulated as follows: for the intestinal complications, small doses frequently repeated (ten drops); as a stimulant to the vaso-motor nervous system, larger doses (m. x—ʒ ss) at somewhat longer intervals.

In the article on "PHOSPHORUS" attention has been called to the utility of turpentine in poisoning by this substance.

The physiological effects of turpentine indicate its utility in certain disorders of the nervous system. As an enema turpentine has been used for its derivative effect in *insolation* or *sunstroke* (Levick, Wood), and in *cerebro-spinal meningitis* (Hirsch). So accurate an authority as Topinard maintains the utility of this remedy in the cystic complications of *posterior spinal sclerosis.* Turpentine has long been used successfully in *epilepsy*, but in those cases only in which the seizures were due to the reflex impression of intestinal parasites (tæniæ). *Tic-douloureux* and *sciatica*, when rheumatic in origin, or when produced by fecal accumulations, have been cured by the vigorous use of turpentine, but we have now other means of treatment more generally useful and less disagreeable.

As turpentine is largely eliminated by the bronchial and renal mucous membrane, decided effects are produced at these points. In diffusing outward, a change in the tonicity of the vessels, and in the character of the secretions, must necessarily be produced. Clinical experience confirms the deductions of theory. In *chronic bronchitis*, with profuse expectoration (bronchorrhœa), especially when the expectorated matters have a fetid odor, turpentine is an excellent remedy (Oppolzer). In *gangrene of the lung*, although it is not curative, it acts beneficially in diminishing the fetor. In *pneumonia* and *capillary bronchitis*, when the vital powers are depressed, and the peripheral circulation is feeble, turpentine is one of the best stimulants which we can employ. The depression which occurs during the period of crisis in pneumonia, and the condition of purulent infiltration, especially indicate the use of this remedy. In the so-called *humid asthma*, and in *emphysema* with profuse bronchial catarrh, good results are obtained by the use of turpentine. In these various pulmonary maladies, the action of turpentine is largely local, as already explained, but it should not be forgotten that the powerful stimulation of the cutaneous circulation which it causes must contribute no small share of the curative action.

In *hydro-nephrosis* and *pyo-nephrosis* turpentine is used as in bronchial catarrh, viz., to alter by actual contact the relaxed condition of the vessels, and the pathological secretions of the mucous membrane. It is of course contraindicated during the existence of acute symptoms. *Chronic catarrh of the bladder* is not unfrequently much improved by the use of this agent. It is most serviceable in those cases resulting from a transference of urethral inflammation, or due to prostatic disease. *Incontinence of urine*, the result of atony of the muscular layer of the bladder, is sometimes removed by small doses of turpentine. *Chronic gonorrhœa*, *gleet*, *spermatorrhœa*, and *prostorrhœa*, when the discharges peculiar to these maladies are due to a relaxed condition of the affected parts, are not unfrequently remarkably benefited by moderate doses of turpentine.

External Uses of Turpentine.—The author long ago pointed out the fact that turpentine is one of the most efficient applications in *hospital gangrene.* The mortified parts are first removed with the scissors, and the remedy is then applied directly to the affected surface, by means of a piece of cotton cloth saturated with it. Fetor is removed and sloughing is arrested, and but little pain attends the application.

Turpentine-stupes are much employed as a local and external means of treating internal inflammations. A piece of spongio-piline, or of flannel, large enough to cover the affected part, is first moistened with hot water, and then a few drops of turpentine (five to ten drops only) are sprinkled on it. As very severe smarting, inflammation, and vesication of the skin may occur from the application, and be experienced, indeed, some time subsequently to the removal of the stupe, care must be used not to continue it too long.

Liniment of turpentine is a convenient counter-irritant in cases of *myalgia, superficial neuralgia, lumbago,* etc. An excellent counter-irritant application is made by mixing equal parts of oil of turpentine, acetic acid, and liniment of camphor (Stillé). The most successful treatment of severe *burns* is by the plan of Kentish, which consists in first washing the injured surface with turpentine, and then applying an ointment made by mixing basilicon ointment with turpentine. *Erysipelas* has been treated by the same measures by Meigs, and the same applications are generally in use in *chilblains.*

Inhalations of turpentine-vapor, or atomized turpentine, is an efficient means of local treatment in *chronic laryngeal and bronchial affections.* As a matter of curious therapeutics, it may be mentioned that gonorrhœa has been successfully treated by requiring the patient to inhale the vapor of turpentine.

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Copaiba.—Copaiba. "The oleo-resin of copaifera multifuga, and of other species of copaifera." *Baume de copahu*, Fr.; *Copaiva-Balsam*, Ger. Dose, m. x—ʒ j.

Pilulæ Copaibæ.—Pills of copaiba. (Copaiba, ℥ ij; magnesia, ʒ j.)

Oleum Copaibæ.—Oil of copaiba. Dose, m. v—ʒ ss.

Composition.—Balsam of copaiba differs from the true balsams in not containing cinnamic acid. It is an oleo-resin, the volatile oil constituting from forty to sixty per cent. The oil of copaiba is isomeric with the oil of turpentine, but it differs in some of its physical properties from the latter. The resin has an acid reaction, and has been entitled *copaivic acid.*

Actions and Uses.—Copaiba has a nauseous, bitter, and very disagreeable taste. When taken into the stomach it causes some heat, and offensive eructations, tasting of the balsam, occur. Indigestion, heaviness at the epigastrium, anorexia, are frequently produced by it, and diarrhœa is an occasional result of its use. It is, therefore, a gastro-intestinal irritant. Both the oil and the resin diffuse into the blood. The various excretions, the sweat, the bronchial mucus, the urine, acquire a peculiar and rather a fragrant odor from its presence. This odor is especially observable in the urine, and in this secretion the resin may be discovered also by the addition of nitric acid, which causes a precipitate. At the points of elimination more or less irritation is produced, and, as a result of the irritation, increased secretion; hence copaiba is said to be diaphoretic, diuretic, and expectorant. Very serious injury may be done to the gastro-intestinal canal, and to the kidneys, by the use of this agent in large doses. The author has known gastro-intestinal catarrh to persist many months after a course of balsam, and he has reason to believe that desquamative nephritis and fibroid kidney have resulted from its free administration for a lengthened period. While small doses of balsam will increase the gross amount of urine and of the solid contents, large doses will actually cause a diminution in the amount both of water and solids by setting up renal irritation. Although, during a course of balsam, nitric acid causes a precipitation of the resin, which is dissolved on the addition of alcohol, the author has, in several instances at least, detected albumen in the urine of those taking this remedy.

Copaiba is contraindicated when a condition of gastro-intestinal irritation and hyperæmia of the kidneys exist.

Gonorrhœa is the disease to which copaiba is most especially adapted. Its administration should not be begun, however, until after the acuter symptoms have subsided. As the action of the remedy is local or direct, acute symptoms are rather aggravated by it. Combination with liquor potassæ promotes its curative action by diminishing the acidity, and hence the irritation produced by the urine. Combination with agents acting synergistically, as oils of cubebs and sandalwood, is also desirable. The following formulæ exemplify these therapeutical facts: ℞. Copaibæ, pulv. cubebæ, āā ℥ ij; aluminis, ℥ j; opii, gr. v. M. Sig. *One to two drachms, night and morning.* ℞. Ol. copaibæ, ol. cubebæ, ol. santal. flav., āā ʒ j; magnesiæ, ʒ ij. M. ft. pil. no. lx. Sig. *Two pills every four hours.*

In *chronic catarrh of the bladder*, copaiba is useful by virtue of the local action which it has upon the mucous membrane. Its nauseous taste and the gastric and renal irritation produced by it are serious objections to its use in a malady which requires the persistent and long-continued application of remedies in order to even moderate its symptoms.

For *acute bronchitis* after the subsidence of the fever, for *chronic bronchitis* with profuse secretion, for *bronchorrhœa* (dilated bronchi), copaiba is the most generally serviceable expectorant. Unfortunately, it is so disagreeable that it is difficult to overcome the repugnance of patients. Even when administered in capsules, or in pill-form with magnesia, the nauseous eructations excite disgust. ℞. Copaibæ, balsam. tolutan., pulv. acaciæ, āā ℥ ss; acid. sulphur. aromat., ʒ ss; aquæ destil., ℥ vj. M. Sig. *A tablespoonful, two or three times a day, in chronic bronchial affections, whooping-cough,* etc. ℞. Copaibæ, syrp. tolutan., āā ℥ ss; aquæ menthæ pip., ℥ ij; spirit. etheris nitrosi, ℥ j. M. Sig. *A teaspoonful every four hours.*

Excellent results have been obtained from the use of copaiba in *dropsy*, especially in *ascites*. In these cases it acts powerfully on the kidneys. Wilkes holds that copaiba-resin is a more efficient diuretic than the balsam. ℞. Res. copaibæ, ʒ iij; alcohol., ʒ v; spirit. chloroformi, ʒ j; mucil. acaciæ, ℥ ij; aquæ ad ℥ xij. M. Sig. *A tablespoonful ter in die.*

In some subjects possessed of an irritable skin, copaiba produces an eruption of urticaria, or roseola, or erythema. This is not in consequence of a selective action on the skin, but is the result merely of the gastro-intestinal disturbance. Influenced, probably, by this fact that an eruption may be caused by copaiba, this agent has been proposed as a remedy in certain *cutaneous diseases*, those characterized by torpor of the peripheral circulation.

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Cubeba.—Cubeb. "The unripe fruit of cubeba officinalis (Miquel), piper cubeba (Linn.)." *Cubèbes*, Fr.; *Cubeben*, Ger.

Extractum Cubebæ Fluidum.—Fluid extract of cubeb. Dose, ʒ ss —ʒ ij.

Oleum Cubebæ.—Oil of cubeb. Dose, m. v — ʒ ss.

Oleoresina Cubebæ.—Oleo-resin of cubeb. Dose, m. v— ʒ ss.

Tinctura Cubebæ.—Tincture of cubeb. Dose, ʒ ss— ʒ ij.

Trochisi Cubebæ.—Troches of cubeb.

COMPOSITION.—Cubeb contains a volatile oil which varies in proportion from six to fifteen per cent. It is polymeric with oil of turpentine. This volatile oil separates in the cold into two distinct substances —a camphoraceous substance (*cubebene*), and a liquid portion (*cubeben*). Besides these, a neutral crystallizable principle (*cubebin*) has been isolated. Cubeb also contains a resin, divisible into two distinct substances, an indifferent portion and an acid (*cubebic acid*). The therapeutical properties of the drug reside chiefly, if not exclusively, in the oil and resin, hence the oleo-resin is an efficient preparation.

ACTIONS AND USES.—The taste of cubeb is aromatic, pungent, and somewhat camphoraceous. In the stomach it excites a sensation of warmth, and, in moderate doses, promotes the appetite and the digestive capacity. In considerable doses it is laxative, and produces a feeling of heat and irritation about the rectum. Ingested in a large quantity cubeb sets up a gastro-intestinal catarrh, and may even cause acute inflammatory symptoms. The active principles diffuse into the blood. The action of the heart and vascular system is increased by cubeb, the surface becomes warm and perspiring under its use, and the bronchial and urinary secretions are more abundant. The odor of cubeb is imparted to the breath and to the urine, and the resin may be precipitated from the urine by the addition of nitric acid. As explained in the previous article (COPAIBA), the resin precipitated by nitric acid resembles albumen, but differs from the latter substance in being soluble in alcohol.

Cubeb stimulates the venereal appetite in man, and promotes the catamenial flux in women.

Finely-powdered cubeb is an efficient local application in *chronic nasal catarrh.* It is blown into the nares by an insufflator. It gives considerable relief also in *hay-asthma*, when there is no fever, and the secretion of the nasal mucous membrane is profuse and watery. Powdered cubeb is useful as a topical application when the mucous membrane of the fauces is relaxed, or the seat of chronic inflammation (*follicular pharyngitis*). The officinal cubeb-troches are employed by singers and public readers, to maintain the tonicity of the mucous membrane and to prevent or relieve hoarseness.

Cubeb may also be used, in small doses, to promote secretion and increase digestion in cases of *atonic dyspepsia. Chronic catarrh of the* *colon and rectum*, with a relaxed condition of the mucous membrane and of the inferior hæmorrhoidal vessels, may be removed by cubeb. Sometimes these cases take the form of a mucous dysentery.

The most important application of cubeb is in the treatment of *gonorrhœa.* Unlike copaiba, it may be administered with good effect during the acute stage. The best results are obtained from a mixture of the two agents. *Catarrh of the bladder*, *prostorrhœa*, *spermatorrhœa*, are maladies in which cubeb may be employed with more or less advantage. When the sexual appetite is weak, and the erections feeble, cubeb will sometimes, if the troubles are functional, remove them.

Irritability of the bladder, nervous or functional in character, especially as it occurs in women, is generally relieved by cubeb; but cantharides is a more efficient remedy for this troublesome affection.

In *chronic bronchial affections*, with profuse expectoration, cubeb has a remedial effect similar to that possessed by copaiba, and is useful under the same conditions.

Piper.—Black pepper. "The unripe berries of piper nigrum." *Poivre noir*, Fr.; *Schwarzer Pfeffer*, Ger.

Composition.—Pepper contains a resin and an essential oil, and a neutral crystallizable principle (*piperine*).

Oleoresina Piperis.—Oleo-resin of black pepper. This contains the active constituents of pepper, and is an eligible preparation. Dose, m. j—m. v.

Capsicum.—Capsicum. "The fruit of capsicum annuum, and of other species of capsicum." *Poivre d'Inde*, Fr.; *Spanischer Pfeffer*, Ger.

Composition.—The acrid, pungent qualities of capsicum are due to a peculiar substance (*capsicine*), a thick, yellowish-red liquid. Fellétar, whose observations have been confirmed by Flückiger, has isolated a volatile alkaloid having the odor of coniine.

Infusum Capsici.—Infusion of capsicum (℥ ss—Oj).

Oleoresina Capsici.—Oleo-resin of capsicum. Dose, m. j—m. v.

Tinctura Capsici.—Tincture of capsicum. Dose, m. x—ʒ j.

Actions and Uses.—Notwithstanding black and red pepper belong to different orders, they are closely related therapeutically and in their physiological actions. They may with propriety be considered together.

When applied to the skin, pepper excites redness, heat, and superficial inflammation. Red pepper, if in contact with the skin a sufficient length of time, will produce vesication. It also causes great irritation of the mucous membrane. It has a hot, pungent, and rather acrid taste, and increases the flow of saliva. In the stomach a sensation of warmth is produced by it, the secretions are more abundant, digestion is more active, and the appetite is promoted. In an excessive quantity gastritis may be produced. The intestinal secretions are no doubt increased, and the alvine evacuations rendered more easy and copious.

The action of the heart and arteries is increased by pepper, a subjective sensation of warmth is experienced throughout the system, and cutaneous transpiration becomes more abundant. Elimination takes place chiefly through the kidneys. The flow of urine is increased, micturition is more frequent, and more or less vesical tenesmus occurs. Decided aphrodisiac effects are produced by red pepper.

The tincture of capsicum may be usefully employed as a stomachic in *atonic dyspepsia.* It is especially indicated in the *dyspepsia of chronic alcoholism,* when there are present trembling and insomnia. *Flatulent colic* may be relieved by capsicum, especially when this disorder occurs in hysterical subjects. The author has seen excellent results from the use of this remedy in the dyspepsia and flatulence of hypochondriacal subjects, and of women at the climacteric period.

Capsicum is an excellent addition to beef-tea when this aliment is administered in *fevers,* and other low conditions of the system. The tincture may be employed under the same circumstances as a cardiac stimulant.

The evidence is conclusive that capsicum quiets restlessness, and induces sleep in *delirium tremens.* It may be administered mixed with beef-tea or other animal broths, or thirty grains made into a bolus, with sirup or honey, may be given. As capsicum belongs to the family Solanaceæ, and as Fellétar discovered in it a volatile alkaloid, a rational explanation is afforded of its action on the cerebrum. According to Ringer, the tincture of capsicum is the best substitute for the stimulant when an attempt is made to break the *alcohol-habit.* It is also very serviceable in the treatment of the *opium-habit.* The good effect of the remedy in these cases is in part due to its action as a stomachic stimulant, and partly, doubtless, to its cerebral effects.

The oleo-resins of black and red pepper have been used with good results in the treatment of *intermittent fever.* They are useful chiefly as adjuvants to more efficient remedies.

Capsicum is contraindicated in all acute affections of the genito-urinary apparatus. In *chronic parenchymatous nephritis* it checks the waste of albumen. In *chronic pyelitis, chronic cystitis,* and *prostorrhœa,* it has a beneficial effect; but, although similar in action to, it is less efficient than cubeb. Excellent results are often obtained from it in *functional impotence,* and in *spermatorrhœa* from deficient tone. In these genito-urinary maladies, the oleo-resin is the best preparation for administration. ℞. Oleoresinæ capsici, ℈j; ergotini (aq. ex.), ℈ij. M. ft. pil. no. xx. Sig. *One three times a day.*

A capsicum-plaster is a mild *counter-irritant.* The infusion is employed as a gargle in *tonsillitis*, *diphtheria*, and *scarlet fever*. As it is a very irritating application, its use should be restricted to cases characterized by a low grade of action.

Juniperus.—Juniper. "The fruit of juniperus communis." *Baies de genièvre*, Fr.; *Wachholderbeeren*, Ger.

Infusum Juniperi.—Infusion of juniper (℥ j—Oj). Dose, ℥ ss—

Oleum Juniperi.—Oil of juniper. Dose, m. v—m. xx.

Spiritus Juniperi Compositus.—Compound spirit of juniper. (Oil of juniper, ʒ jss; alcohol, Ov; water, Oiij; oils of caraway and fennel, each m. x.) Dose, ℥ ss—℥ j.

Composition.—Juniper contains a *volatile oil*, upon which its medicinal effects chiefly depend. A non-crystallizable principle (*juniperine*) exists in the berries in very small quantity. It contains also formic, acetic, and malic acids.

Actions and Uses.—Juniper increases the appetite and digestion, but in overdoses will disorder the stomach. The volatile oil diffuses into the blood with facility. Increased action of the heart and of the arteries, a subjective sensation of warmth, diaphoresis, and diuresis, are produced by it.

The oil is eliminated by the kidneys chiefly, and imparts an odor of violets to the urine. It powerfully stimulates the renal functions, and in large doses causes strangury and bloody urine. It may set up a high degree of irritation of the kidneys, leading to suppression and uræmic intoxication. In common with the other remedies of this group, juniper excites the venereal appetite, in large doses may cause priapism, and in women promotes the menstrual flow.

The principal use of juniper is as a *diuretic*. It is contraindicated in acute affections of the kidneys. It is largely employed as a diuretic in *cardiac* and *renal dropsy*. The infusion is an excellent vehicle for the exhibition of saline diuretics in these affections. The oil of juniper acts similarly to, and is indicated under the same conditions as, turpentine in *chronic pyelitis*, *chronic cystitis*, *gleet*, *prostorrhœa*, etc. Diuretic effects may be obtained by inhalation of the vapor of the oil. For this purpose a few drops may be put into hot water, and the vapor be inhaled.

The *empyreumatic oil of juniper* (oleum cadinum), obtained by destructive distillation from juniperus oxycedrus, is a thick, black liquid, similar in appearance to and smelling like common tar. It is much employed as a local application in *chronic eczema*, *impetigo*, *ichthyosis*, *psoriasis*, *acne rosacea*, etc. It is usually combined with German softsoap. ℞. Alcoholis, saponis mollis, ol. cadini, āā ℥ j; ol. lavendulæ, ʒ jss. M. ℞. Ol. juniperis empy. (ol. cadini), saponis mollis, āā ℥ j;

ol. lavend., ʒ ss. M. Sig. *Ointment.* ℞. Ol. juniperis empy., ʒ j—℥ j; sevi, ℥ ss; adipis, ℥ j. M. Sig. *Ointment.*

Erigeron.—Erigeron. "The leaves and tops of erigeron heterophyllum, and of erigeron Philadelphicum."

Erigeron Canadense.—Canada erigeron.

Oleum Erigerontis Canadensis.—Oil of Canada erigeron. Dose, m. v.—m. x.

Actions and Uses.—Erigeron possesses a diuretic property to a slight extent. Canada erigeron is the more active, and contains a much larger proportion of volatile oil. The actions and uses of the oil are the same as the oil of turpentine, but the latter is the more efficient remedy. The oil of Canada erigeron has a local reputation in Philadelphia as an *hæmostatic* agent. It is said to be effective in *menorrhagia*, and cases of *intestinal hæmorrhage* arrested by it have been reported. It is adapted only to the treatment of passive hæmorrhages, and is probably less curative than turpentine in these cases.

Buchu.—Buchu. "The leaves of barosma crenata and of other species of barosma." *Feuilles de bucco*, Fr.; *Bukublätter*, Ger.

Infusum Buchu.—Infusion of buchu (℥ j—Oj). Dose, ℥ ss—℥ ij.

Extractum Buchu Fluidum. Fluid extract of buchu. Dose, m. x—ʒ j.

Composition.—Buchu contains a *volatile oil* in the proportion of about 1.5 per cent. This volatile oil consists of a crude oil and a camphor—barosma camphor. The latter has a nearly pure peppermint odor. The existence of *barosmine*, so called, is doubtful.

Uva Ursi.—Uva ursi. "The leaves of arctostaphylos uva ursi." *Feuilles de busserole*, Fr.; *Bärentraubenblätter*, Ger.

Decoctum Uvæ Ursi.—Infusion of uva ursi (℥ j—Oj). Dose, ℥ ss—℥ ij.

Extractum Uvæ Ursi Fluidum.—Fluid extract of uva ursi. Dose, ʒ ss—ʒ ij.

Composition.—Uva ursi contains a bitter, neutral, crystallizable substance, *arbutine;* a very bitter amorphous principle, *ericoline;* and a tasteless, crystallizable, neutral principle, *ursone.* It is rich in gallic and tannic acids.

Pareira.—Pareira brava. "The root of cissampelos pareira." *Racine de pareira-brava*, Fr.; *Grieswurzel*, Ger.

Infusum Pareiræ.—Infusion of pareira brava (℥ j—Oj). Dose,

Extractum Pareiræ Fluidum.—Fluid extract of pareira. Dose ʒ ss—ʒ ij.

Composition.—It contains a principle, *buxine*, but it is not known whether this is the active ingredient.

Chimaphila.—Pipsissewa. "The leaves of chimaphila umbellata."

Decoctum Chimaphilæ.—Decoction of chimaphila. Dose, ℥ ss—℥ ij.

Extractum Chimaphilæ Fluidum.—Fluid extract of chimaphila. Dose, ʒ ss—ʒ ij.

Composition.—Pipsissewa contains a crystallizable principle, *chimaphiline*, tannic acid, extractive matters, etc.

Scoparius.—Broom. "The tops of sarothamnus scoparius. *Genêt à balais*, Fr.; *Pfriemenkraut*, Ger.

There are no preparations officinal to the United States Pharmacopœia. A decoction and fluid extract corresponding to those above mentioned may be employed.

Composition.—Scoparius contains an indifferent or somewhat acid crystallizable principle, *scoparine*, and an oily, colorless, liquid alkaloid, *sparteine*. The latter has very decided basic qualities, and agrees with coniine and nicotine in being constituted without oxygen.

Actions and Uses.—Buchu, uva ursi, pareira, pipsissewa, and scoparius, form a group of diuretics with properties in common. They are tonic, astringent diuretics. They promote appetite and digestion, and restrain intestinal movements, except pareira, which has rather a laxative action. Their active constituents diffuse into the blood and are eliminated by the kidneys. In passing over the genito-urinary tract these principles act topically upon the mucous membrane. As a rule they are actively diuretic; that is, they increase the amount of urinary water. Pipsissewa and scoparius are rather more actively diuretic than buchu and uva ursi, and hence are more useful in dropsy. By English physicians generally, and notably the late Dr. Pereira, scoparius is held in much esteem as a remedy for *dropsy*. It is adapted especially to the treatment of *cardiac dropsy*, and the general anasarca of *chronic parenchymatous nephritis*, but is inadmissible in acute affections of the kidney. Our indigenous remedy, pipsissewa, may be substituted for scoparius in the treatment of dropsy.

Buchu, uva ursi, and pareira, are more particularly useful in *chronic pyelitis*, *catarrh of the bladder*, *chronic gonorrhœa*, etc.; and of these the most efficient, probably, is buchu. The fluid extract is the most eligible form in which these remedies can be administered.

Carota.—Carrot-seed. "The fruit of daucus carota. The wild-carrot."

The seeds of carrot have a hot, pungent, and bitter taste, due to a volatile oil which they contain, and to which their medicinal activity is due. As they impart their virtues to water, an infusion of the seeds is an eligible form in which to administer the remedy. Carrot-seeds act similarly to juniper, and produce diuresis, augment the menstrual flux, and cause aphrodisiac effects in the male.

Taraxacum.—Dandelion. "The root, gathered in the autumn, of taraxacum dens-leonis." *Pissenlit*, Fr.; *Löwenzahnwurzel*, Ger.

Extractum Taraxaci.—Extract of taraxacum. Dose, gr. v—℈j.

Infusum Taraxaci.—Infusion of taraxacum (℥ij—Oj). Dose, ℥ss—℥ij.

Extractum Taraxaci Fluidum.—Fluid extract of taraxacum. Dose, ʒj—℥j.

Composition.—According to Kromayer, taraxacum contains *taraxacine*, an amorphous, intensely bitter principle, and a crystalline substance, *taraxacerine*. Nothing is definitely known as to the action of these substances.

Actions and Uses.—Taraxacum possesses the properties of a simple bitter, in that it promotes the appetite and digestion. It has been long held, both popularly and professionally, to possess the power to promote the flow of bile. Recent investigations have demonstrated the inaccuracy of these opinions. It is a mild laxative, and as such, doubtless, may cause by reflex stimulation an emptying of the gall-bladder. It is a diuretic, although not a very active one. It is still prescribed as a laxative in *catarrhal jaundice*, in *ascites* from hepatic disease, and in *dyspepsia* and *indigestion* associated with torpor of the liver. By German physicians, muriate of ammonia and dandelion are frequently associated together in the treatment of the affections above named. Taraxacum is occasionally used as a diuretic in *dropsy*, but its utility is very limited.

The fluid extract of taraxacum is a good vehicle for the administration of such remedies as the muriate of ammonia and quinia, the taste of which it somewhat covers.

Scilla.—Squill. "The bulb of scilla maritima." *Ognon marin*, Fr.; *Meerzwiebel*, Ger.

Acetum Scillæ.—Vinegar of squill (℥iv—Oij). Dose, m. xx—ʒj.

Pilulæ Scillæ Compositæ.—Compound pills of squill (squill, ginger, ammoniac, soap). Each pill contains half a grain of squill and one grain of ammoniac. Dose, one pill three or four times a day.

Syrupus Scillæ.—Sirup of squill. Dose, ʒss—ʒj.

Syrupus Scillæ Compositus.—Compound sirup of squill. Hive-sirup. This preparation contains squill, senega, and tartar-emetic, the last named in the proportion of one grain to the ounce. Dose, m. v—ʒj. This is a very active preparation, due chiefly to the tartar-emetic.

Tinctura Scillæ.—Tincture of squill. Dose, m. v—ʒ ss.

COMPOSITION.—The important constituent of squill is an acrid, bitter principle, *scillitine*, or skulein—which has not yet been isolated. According to Schroff, scillitine is a glucoside, and the active principle is an acrid, non-volatile substance (Flückiger and Hanbury).

ACTIONS AND USES.—The taste of squill is bitter and somewhat acrid. It is an irritant to the mucous membrane, and excites nausea, vomiting, and purging, when introduced into the stomach in a sufficient dose. Very violent gastro-enteritis may be produced by its incautious administration in large doses. A state of hyperæmia or inflammation of the gastro-intestinal mucous membrane, therefore, contraindicates its use. The active constituents of squill diffuse into the blood. Its systemic effects are produced by application to the external integument. Paralysis and convulsions are induced in warm-blooded animals by toxic doses; and similar cerebral symptoms occur in man, in addition to the phenomena which usually attend the action of an irritant poison. In ordinary medicinal doses squill increases the bronchial mucus and facilitates expectoration. In toxic doses rapid breathing has usually occurred. It is highly probable that a portion of the active constituents of squill is eliminated by the broncho-pulmonary mucous membrane.

Squill stimulates the functions of the kidneys and increases the urinary discharge when used in medicinal doses, but in excessive quantity it excites violent inflammation, with strangury and bloody urine. Suppression of urine may be a result of its irritating action on the kidneys.

The use of squill is confined to its expectorant and diuretic effects. The *acetum* and *syrupus scillæ* enter into the composition of expectorant mixtures employed in the treatment of *catarrh of the bronchial tubes*, after the subsidence of acute symptoms and the chronic forms of the disease. Squill is more particularly indicated when the sputa are tenacious and are coughed up with difficulty. Ipecacuanha is advantageously combined with it in the more recent cases. ℞. Acet. scillæ, ℥ ss; extract. ipecac. fluid., ʒ ss; tinct. opii deod., ʒ j; syrp. tolutan., ʒ x. M. Sig. *A teaspoonful every two, three, or four hours.* ℞. Scillæ, ipecac., āā, gr. vj; ext. hyoscyami, gr. iij; morphiæ sulph., gr. ss—gr. j. M. ft. pil. no. xij. Sig. *One pill every four hours.* In chronic bronchitis with emphysema or dilated right cavities of the heart, squill is better associated with the stimulating expectorants, ammoniac, asafœtida, benzoin, etc. ℞. Syrp. scillæ, ℥ ss; tinct. opii camphor., ʒ ij; ammoniac, ʒ ss; syrp. tolu., ʒ x. M. Sig. *A teaspoonful as necessary.* Squill is an improper remedy when there are present fever and an acute inflammatory condition of the air-passages.

Squill is a very effective diuretic. Since in overdoses it will produce great irritation of the kidneys, it is inadmissible in acute affections of these organs. In dropsy caused by any of the chronic eases of the kidneys, squill must be used with caution. As a diuretic this remedy is more especially useful in *cardiac dropsy.* It may be combined with digitalis or the saline diuretics. ℞. Infus. digitalis, ℥ iijss; acet. scillæ, ℥ ss. M. Sig. *A tablespoonful two or three times a day.* ℞. Digitalis, ℈j; scillæ, gr. x; ext. colchici acet., ℈j. M. ft. pil. no. xx. Sig. *One pill every four or six hours.* When anæmia is present, iron may be added to the above formula. ℞. Acet. scillæ, ℥ ss; liq. potassii citratis, ℥ iijss. M. Sig. *A tablespoonful every four hours.*

Authorities referred to:

FLÜCKIGER AND HANBURY. *Pharmacographia.*
HUSEMANN, DR. THEOD. *Handbuch,* zweiter Band, p. 1175.
KÖHLER, DR. HERMANN. *Handbuch,* p. 515.

Petroselinum.—Parsley-root. "The root of petroselinum sativum."

COMPOSITION.—The most important constituent of parsley is *apiol,* an oily, non-volatile, yellowish liquid, having a distinctive odor and an acrid taste. It contains, also, a gelatinous substance, *apiine* (pectin ?), and a volatile oil.

ACTIONS AND USES.—Petroselinum has a hot, pungent taste, with an after acrid sensation. It is somewhat laxative—a property, doubtless, dependent on the irritation which it produces. It is stimulant in its effects on the circulation, and promotes the cutaneous and bronchial secretions. It is diuretic, by reason of the local irritant action of the principles which are eliminated by the kidneys.

Apiol has decided properties, and in its action strongly resembles quinia. It produces headache, tinnitus aurium, vertigo, intoxication, etc.

Petroselinum is rarely employed for its diuretic effects. Its use is indicated in *dropsy* under the same conditions as juniper, squill, and other stimulating diuretics. It may be given in the form of infusion (℥ j—Oj), one to three ounces at each dose.

Apiol is a remedy of considerable value in the treatment of *malarial diseases,* but it is inferior in every respect to quinia. Its use is only justifiable in the treatment of *intermittents,* and when the prejudices or idiosyncrasies of the patient forbid the use of quinia. Fifteen grains should be administered in one dose, or in divided doses, within an hour, in order to procure the maximum effect, and about four hours previous to the paroxysm.

The evidence is conclusive that *apiol* has decided *emmenagogue* power. It is a stimulant to the uterine system, and therefore is contraindicated in plethora of these organs, and should not be administered as an antiperiodic to pregnant women. It is indicated when a state of torpor of the ovaries and uterus exists. The *amenorrhœa* of anæmia, of functional inactivity, is the form of the malady in which apiol is serviceable. The condition of the blood should be corrected by iron, constipation should be removed by aloëtic purgatives, and the apiol, in a considerable dose (fifteen grains), should then be administered at the time of the menstrual molimen, or just preceding the time when the flow should begin. If the case has been obstinate, a daily dose of apiol may be given for a week, or at least for several days before the menstrual period. The neuralgic form of *dysmenorrhœa* is also benefited by this remedy. Other *neuralgiæ* are, it is said, relieved by apiol, but the existence of a malarial cause is, no doubt, the explanation of its curative action in such cases.

Authorities referred to:

Delorme, Dr. *Gazette des Hôpitaux*, 1860, p. 511.
Joret and Homolle. *Bulletin Général de Thérapeutique*, vol. xlviii., p. 32.
Marotti, Dr. Ibid., 1863, p. 295.
Stillé, Dr. A. *Therapeutics and Materia Medica*, vol. ii., p. 631.
United States Dispensatory, thirteenth edition, article *Petroselinum*.

Polygonum Hydropiperoides.—Water-pepper. This indigenous plant is not recognized by the United States Pharmacopœia. A fluid extract prepared according to the general directions of the United States Pharmacopœia may be prescribed in the dose of m. x. to ℨ j. A solid extract is also to be found in the shops—dose, gr. j—gr. v.

Actions and Uses.—The taste of hydropiper is hot, pungent, and acrid. The juice excites inflammation and vesication when applied to the external integument. In medicinal doses it causes a sensation of warmth in the stomach, and a "peculiar tingling sensation throughout the whole system" (Eberle). Unless given in an overdose it does not excite vomiting or produce purging. It stimulates the heart and arteries, increases the warmth of the surface, and promotes the cutaneous, bronchial, and renal secretions. It promotes the menstrual flow, and is aphrodisiac.

This indigenous but little known remedy is a very efficient stimulating *diuretic* and *emmenagogue*. The author can confirm the statement of Eberle, who reports that "with no other remedy or mode of treatment has he been so successful as with this," in *amenorrhœa*. It is adapted to cases of amenorrhœa due to functional inactivity or torpor of the uterine system, and is contraindicated when a condition of plethora or congestion exists. The administration of this remedy should be begun about a week before the menses ought to appear. Thirty minims of the fluid extract should be administered four times a day. If anæmia exist, iron should be given; if constipation, aloes.

Hydropiper is a remedy of considerable power in *functional impotence*. When the erections are feeble, the seminal fluid watery, and the testes soft, good results will be obtained from the use of this remedy, provided no structural alterations hinder or prevent improvement.

When hydropiper is administered in these disorders of the sexual system, it causes a feeling of weight and tension, and dragging of the pelvic viscera. As it tends to increase the blood-supply to these organs, it is inadmissible when a state of congestion or inflammation exists.

Authorities referred to:

EBERLE, DR. JOHN. *A Treatise of the Materia Medica and Therapeutics*, fourth edition, vol. i., p. 441.

PORCHER, DR. C. PEYRE. *Resources of the Southern Fields and Forests*, p. 409.

UNITED STATES DISPENSATORY, thirteenth edition, p. 1546.

Ruta.—Rue. "The leaves of ruta graveolens."

COMPOSITION.—The medicinal activity of this plant depends on the presence of a *volatile oil*. Only the fresh leaves should be employed, and, as drying impairs the quality of the drug, the oil should be prescribed.

Oleum Rutæ.—Oil of Rue (unofficinal). This is a volatile oil, of a greenish-yellow color, very disagreeable and characteristic odor, and pungent, acrid taste. Dose, m. j—m. v.

ACTIONS AND USES.—In its local action rue is an irritant; applied to the skin, the oil causes heat, inflammation, and vesication. In ordinary medicinal doses a sensation of warmth follows its introduction into the stomach, and increased action of the heart and arterial system and a subjective feeling of peripheral heat are subsequently produced. The cutaneous, bronchial, and urinary excretions become more abundant, and the odor of the volatile oil is apparent in the breath, the sweat, and the urine. In toxic doses the oil of rue produces violent gastro-enteritis, prostration, convulsive muscular movements, hebetude of mind, etc., strangury and suppression of urine. In women the use of rue increases the menstrual flow, and large doses may cause abortion to take place. In men this agent promotes the sexual appetite, and increases the vigor of the erections.

A tincture of the oil of rue is an efficient carminative and antispasmodic remedy in the *flatulent colic* and *hysteria* of women. Almost the only use of rue at present is in the treatment of *amenorrhœa*. It is one of the most efficient emmenagogues. Plethora, congestion, or inflammation of the pelvic viscera, contraindicates its use. Functional inactivity of the ovaries and uterus is the condition which justifies the employment of rue. It has been recommended in *menorrhagia* when the vascular tonus is low, and in *uterine hæmorrhage* after miscarriage. It need hardly be remarked that the condition of pregnancy forbids the use of rue.

Sabina.—Savine. "The tops of juniperus sabina." *Sabine*, Fr.; *Sevenkraut*, Ger.

COMPOSITION.—Savine contains an *essential oil*, in the proportion of two to two and a half per cent. in the tops and about ten per cent. in the berries. The oil of savine is isomeric with the oil of turpentine.

Oleum Sabinæ.—Oil of savine. Dose, m. j—m. v.

Extractum Sabinæ Fluidum.—Fluid extract of savine. Dose, m. v—m. xv.

Actions and Uses.—Savine has a strong, disagreeable odor, and a pungent, acrid taste. Applied to the skin the oil causes inflammation and vesication, if the contact be sufficiently prolonged. Introduced into the stomach in a full medicinal dose, a sensation of heat, eructations tasting of the oil, flatulence, and nausea, are produced. A toxic dose sets up a violent gastro-enteritis. The oil diffuses readily into the blood, and is excreted by various channels—the breath, the sweat and the urine, smelling strongly of it. Increased action of the heart and a rise of tension of the arterial system, followed by diminished tonus of the vessels, result from its administration in full medicinal doses. The cutaneous, bronchial, and urinary excretions are rendered more abundant by savine. Strangury and bloody urine are caused by it in overdoses. The evidence is conclusive that savine exerts a powerful influence on the uterine system. It increases the menstrual flux, and in toxic doses may originate uterine action and cause abortion. The abortifacient effect cannot be obtained unless by the administration of a quantity sufficient to endanger life.

The only use to which savine is now applied is in the treatment of *amenorrhœa.* It is generally conceded that the estimate of its powers made by Pereira is not extravagant, namely, that "it is the most certain and powerful emmenagogue of the whole materia medica." Savine is indicated in amenorrhœa dependent on deficient activity of the sexual system, accompanied by general atony. It is inadmissible when a tendency to congestion of the pelvic viscera is present, or in a condition of general plethora. Cases of *dysmenorrhœa* are benefited by savine when the subject is of relaxed habit, the menstrual flow being scanty, provided narrowing of the cervical canal is not the cause of the painful and difficult menstruation. *Menorrhagia,* when due to an enlarged, relaxed, and passively congested uterus, and *hæmorrhage after abortion,* may sometimes be arrested by this agent.

The most effective preparation of savine is the oil. This may be prescribed in gelatine-capsules, in an emulsion, or in pillular form. The fluid extract, if made from the fresh tops, is an excellent preparation. Combination with other remedies of the same group increases the action of savine. ℞. Ol. sabinæ, ʒ j; ol. rutæ, ʒ j; tinct. polygon. hydropiper, ℥ j; ol. amygdal. express., mucil. acaciæ, aquæ menth. pip., āā ʒ ij. M. Sig. *A teaspoonful twice or three times a day as an emmenagogue.*

Authorities referred to:

Aran, M. *Bulletin Général de Thérapeutique*, vol. xxx., p. 61.
Beau, M. Le Dr. Ibid., vol. xliii., p. 140.
Flückiger and Hanbury. *Pharmacographia.*
Husemann, Dr. Theodor. *Handbuch*, zweiter Band, p. 1200.

KÖHLER, DR. HERMANN. *Handbuch*, p. 387.
TAYLOR, DR. A. S. *On Poisons*, third edition, London, p. 494.
VAN DE WARKER, DR. ELY. *The Detection of Criminal Abortion*, 1872.

Cantharis.—*Cantharides.* Cantharis vesicatoria. *Cantharide*, Fr.; *Spanische Fliegen*, Ger. *Tinctura Cantharidis.* Tincture of cantharides. Dose, m. ij—m. v.

(The other preparations of cantharides, which are used externally only, will be taken up in Part III. of this work.)

COMPOSITION.—The principal constituent of cantharides is a neutral, crystallizable principle, *cantharidine.* It contains also an oil, fatty matter, and an odorous material.

ANTAGONISTS AND INCOMPATIBLES.—There is no chemical or physiological antagonist to cantharides. Poisoning by this substance should, therefore, be treated on general principles. The stomach should be evacuated by emetics or the stomach-pump; mucilaginous substances should be freely administered; the gastro-enteritis should be treated by opium, etc.

SYNERGISTS.—Oils and fats increase the solubility and favor the absorption of cantharidine. The physiological actions of this agent are promoted by the other agents of this group.

PHYSIOLOGICAL ACTIONS.—The odor of cantharides is nauseating, fetid, and peculiar. In contact for a sufficient time with the skin or mucous membrane, it excites considerable burning, inflammation, and vesication. In the stomach it causes a sensation of heat, severe gastralgia, nausea, and vomiting. Notwithstanding the insolubility of cantharidine, it readily diffuses into the blood. It is actively stimulating to the circulatory system, and a rise of temperature, with thirst, follows in an hour or two. Under these circumstances, the urine becomes scanty and burns the passages; severe pain is experienced in the back and loins; priapism occurs; and the urine, voided with great difficulty, frequently contains albumen and blood. To this excitement of the circulatory system and of the genital organs succeeds a condition of depression, in which the pulse falls, the arterial tension is lowered, and the temperature declines (Radecki).

When a toxic dose is swallowed, in a short time a sense of constriction of the œsophagus, with difficulty of swallowing, and ptyalism, occur. Intense gastric pain, vomiting of glairy mucus streaked with blood, intestinal pain, abdominal tenderness, tenesmus, and mucous and bloody stools, are produced. Violent irritation of the genito-urinary organs is also experienced, manifested by lumbar pain, strangury and bloody urine, priapism, swelling and inflammation of the external genitals. In most cases of poisoning by cantharides, cerebral effects, consisting of muscular trembling, partial or general convulsions, coma, and insensibility, are produced. Abortion has been caused by toxic doses of cantharides, and after death violent metro-peritonitis, gastro-enteritis, and general peritonitis have been observed. It is questionable whether abortion can be caused by a dose less than dangerous.

Cantharides has frequently caused dangerous symptoms, when used with a view to induce venereal excitement. That it does promote the sexual appetite is probably true, but this result is accomplished only by the use of a quantity sufficient to cause vascular turgescence of the sexual organs.

THERAPY.—In *acute desquamative nephritis*, after the subsidence of the acuter symptoms, good results are obtained from cantharides. The local condition in which this remedy is serviceable consists in hyperæmia with loss of vascular tonus. *Chronic pyelitis* and *chronic catarrh of the bladder* are occasionally remarkably benefited by the long-continued use of small doses of cantharides. *Irritability of the bladder*, more especially as it occurs in women, without the existence of acute inflammation, and not produced by uterine displacements, is sometimes quickly and entirely relieved by this remedy. The irritable state of the bladder and the vesical tenesmus, which accompany chronic prostatic disease, are also sometimes surprisingly relieved by cantharides, but the author is unable to indicate the special circumstances to which it is adapted.

Gleet and *prostorrhœa* are benefited by cantharides when these maladies occur in subjects of a relaxed fibre, with feeble circulation. Ringer makes the extraordinary statement that one drop of the tincture given three times a day will prevent *chordee.*

When *spermatorrhœa* actually exists, and is due to deficient tone of the seminal vesicles, the erections being feeble, and the sexual feeling torpid, good results are obtained by the use of cantharides. In cases of *scanty menstruation*, occurring in women of lax fibre, with cold hands and feet, improvement follows the use of this remedy. It sometimes happens that *menorrhagia* is due to relaxed vessels and a general lowering of the vascular tonus: under such circumstances cantharides may render important service. In these disorders of the sexual system, characterized by deficient power, the good effects of cantharides are promoted by the use of iron. The tincture of cantharides is the most eligible preparation for internal administration. In chronic affections of the genito-urinary passages the dose will range from two to five drops —rarely the latter—three times a day.

Authorities referred to:

CASPER's *Practisches Handbuch der gerichtlichen Medicin*, by Liman, zweiter Band, p. 576.

HUSEMANN, DR. THEOD. *Handbuch*, zweiter Band, p. 588, *et seq.*

RADECKI, FR. *Die Cantharidinvergiftung.* Inaug. Diss. *Schmidt's Jahrbücher*, vol. cxxxviii., p. 17.

RINGER, DR. SYDNEY. *Handbook of Therapeutics.*

TAYLOR, DR. A. S. *On Poisons*, fourth edition, London, p. 524.

PART III.

TOPICAL REMEDIES.

ANTISEPTICS.

THOSE remedies are entitled *antiseptic* which are employed to arrest fermentative processes. It is now generally admitted that every kind of fermentation is correlative of the growth and multiplication of a living organism. In various diseases, microzymes, vibrio, bacteria, either stand in a causative relation to the morbid process, or are necessary to its evolution and development. As an exemplification of the influence exerted by these minute organisms in diseased states, I may mention the bacteria of Oertel, which are formed in such immense numbers, and attain to such wide diffusion in diphtheria, the protomycetes of Obermeier, which play so important a *rôle* in relapsing fever, and the specific bacteria (cacobacteria) found by Burdon-Sanderson in the exudation of septic inflammation of the peritonæum. Disease-germs, which may not exist in definitely-organized forms, are, at least, constituted of living matter, having properties apparently similar to those ferments with which chemistry has made us acquainted.

The remedies of this group—antiseptica—have the power, when brought into contact with the minute organisms or disease-germs mentioned above, to destroy their vitality, and to arrest the fermentation process, or zymosis, which they either initiate or promote. Some of these remedies, e. g., quinia, sulphurous acid, the sulphites, etc., have already been discussed in Part II. Under this head there remain for consideration several important agents whose applications are chiefly topical, and are therefore most appropriately considered in this section.

Oxygenium.—Oxygen, *Ozone. Oxygène*, Fr.; *Sauerstoff*, Ger. A permanent, elastic gas, inodorous, without taste, incombustible, but uniting with bodies in a state of combustion. It is very slightly soluble in water at the ordinary temperature and pressure.

The quantity of oxygen which may be inhaled, in the ordinary medicinal applications of this gas, ranges from one to five gallons.

PHYSIOLOGICAL ACTIONS.—If the important *rôle* which oxygen plays in the economy of Nature furnished a measure of its powers when administered as a remedy, it would be a most important therapeutic agent. When inhaled in the pure state (not as air), it produces singularly little constitutional disturbance. A sensation of warmth in the larynx, trachea, and bronchi, is first experienced; the pulse, as a rule, somewhat increases, though it may be lessened in frequency; a sense of mental exhilaration and a disposition to greater bodily activity are produced; the appetite becomes keener; but no constant influence on the excretions has been noted (Demarquay). Experiments on animals have demonstrated that the inhalation of oxygen *per se* does not have an injurious effect on animal life (A. H. Smith).

THERAPY.—Oxygen is indicated and has been used with success in diseases of the respiratory organs, characterized by *dyspnœa*, due to causes interfering with the oxygenation of the blood, in *emphysema*, *asthma*, *croup*, *asphyxia*, *chloroform narcosis*, *asphyxia from toxic gases*, etc. In these cases oxygen acts in a manner which is perfectly obvious: the labor of breathing and the damage to the respiratory centre are lessened by the addition to the blood of oxygen in larger quantity than is supplied by the air. In these cases, pure oxygen, or a mixture of one part of the gas to two or three of air, may be employed. The more extreme the dyspnœa, the greater the necessity for undiluted oxygen.

Oxygen is also indicated, and has been successfully employed, in certain diseases characterized by insufficient oxidation: *chlorosis*, *anœmia*, *leucocythemia*, *diabetes*, *albuminuria*, etc. In such cases the internal administration of chalybeate medicines, or mineral waters, should accompany the inhalations of oxygen. Pure oxygen is not necessary; an admixture with three parts of air will suffice, and the inhalation should be made morning and evening.

The evidence is satisfactory that oxygen-inhalations produce good results in some cases of *phthisis*. Those cases appear to be most benefited in which emaciation, dyspeptic symptoms, etc., have occurred, without marked change in the condition of the lungs. When hectic fever comes on, and excavations have occurred, the utility of oxygen has ended, except as a palliative of dyspnœa.

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Chlorinium.—Chlorine. *Chlore*, Fr.; *Chlor*, Ger.

Properties.—Chlorine is a greenish-colored gas, of a persistent, penetrating, suffocating, and characteristic odor. It is soluble in water in the proportion of two volumes (of gas) to one.

Aqua Chlorinii.—Chlorine-water. "Is a greenish-yellow liquid, possessing the suffocating odor of chlorine."

Liquor Sodæ Chlorinatæ.—Solution of chlorinated soda. "A transparent liquid, of a greenish-yellow color, having a slight odor of chlorine, and a sharp, saline taste."

Calx Chlorinata.—Chlorinated lime. Chloride of lime. "A grayish-white substance, in powder or friable lumps, dry or but slightly moist, and wholly dissolved by dilute muriatic acid, with the escape of chlorine."

Physiological Actions.—Chlorine as a gas, or in solution in water, is an active irritant. Applied to the skin for some minutes it causes heat and burning, increased diaphoresis, and, if the contact be sufficiently prolonged, vesication. Inhaled in very small quantity, largely diluted with air, this gas induces a sensation of warmth in the chest, and increases the bronchial mucus. In considerable quantity it is a violent irritant, excites spasm of the glottis, and sets up active inflammation of the larynx, bronchi, and lungs.

Chlorine is without action when moisture is not present. Water is decomposed by it, chlorhydric acid is formed, and oxygen set free as active oxygen or ozone. The antiseptic and antiferment properties of chlorine are, therefore, due to the oxidizing powers of the liberated ozone. The sulphur and phosphorus compounds with hydrogen are decomposed by chlorine. When this gas is brought into contact with sulphuretted hydrogen, chlorhydric acid is formed and sulphur is precipitated. On these chemical facts rest the deodorant and disinfectant powers of chlorine.

Therapy.—Chlorine gas will arrest putrefactive decomposition of animal matters, and may, therefore, be employed as a preservative of *anatomical preparations.* As a deodorant and disinfectant it may be used to destroy *foul effluvia* and *disease-germs.* It is irrespirable in sufficient quantity to affect disease-germs in the living subject, and it destroys the colors and even texture of fabrics, so that it is rarely used for disinfection of the person, or of the clothing of patients.

Chlorine-water, chlorinated soda, and solutions of chlorinated lime, are employed locally in *scarlet fever*, *diphtheria*, *aphthæ*, and *gangrene of the mouth and fauces.* Their chief utility consists in removing fetor, but they probably, also, exert a toxic influence on disease-germs. ℞. Aquæ chlorinii, ℥ ss; aquæ destil., ℥ iijss; syrupi simpl., ℥ ss. M. Sig. *As a gargle, or lotion for the mouth.* ℞. Calc. chlorinat., ʒ ss; mucilaginis, ℥ ss; aquæ destil., ℥ iijss. M. Sig. *Lotion.* To correct fetor of the breath, the following formula may be used: ℞. Calc. chlorinat., ʒ iij; aquæ destil., alcoholis, āā ℥ ij; ol. rosæ, gtt. iv. M. Sig. *A teaspoonful to a tumblerful of water.*

Chlorine-water was formerly much employed in *scarlet fever*, *typhoid*, *typhus*, *etc.* Its use in these affections was predicated on its presumed power to arrest the zymosis of the morbid ferments. It need hardly be stated that such notions are no longer entertained.

These chlorine preparations are unquestionably serviceable as detergent, deodorant, and antiseptic applications to *sloughing and gangrenous wounds.* A solution of chlorinated soda is employed to prevent infection by animal poisons, the *bite of serpents and insects*, and the *syphilitic virus.*

Formerly chlorine-water and chlorinated soda were used in *chronic hepatic affections*, but there is no evidence that they are serviceable.

The toxic effects of chlorine gas may be prevented by ammoniacal gas (ammonium chloride). Albumen is the most suitable and convenient antidote to the chlorine preparations taken into the stomach. It should be given freely in the form of milk, eggs, flour, etc.

Brominium.—Bromine. *Brome*, Fr.; *Brom*, Ger. "A dark-red liquid, having a strong, disagreeable odor. It is sparingly soluble in water, more soluble in alcohol, and still more so in ether."

Physiological Actions.—The actions of bromine, considered from the chemical point of view, are similar to those of chlorine; it decomposes hydrogen compounds, forming bromhydric acid, and precipitating or separating the element associated with hydrogen. It is therefore a deodorant and antiseptic. The vapor of bromine is intensely irritant to the air-passages. It combines with the water and sets free ozone, which energetically attacks the mucous membrane. In sufficient quantity, laryngitis, bronchitis, and pneumonia, will be produced by the inhalation of its vapor. Applied in the liquid form, and undiluted, bromine acts as an energetic and very painful escharotic. A brownish slough is formed, which is afterward slowly detached. Internally, by the stomach, bromine acts as a corrosive poison, producing violent gastritis, and the phenomena of depression and collapse, which attend the action of corrosive poisons in general.

Therapy.—The vapor of bromine is an efficient remedy in *acute coryza* and *hay-asthma.* ℞. Brominii, ʒ ss; alcoholis, ℥ iv. M. Sig. *For inhalation.* A small quantity of this solution may be placed in a wide-mouthed vial, and vaporized by the warmth of the hand. The vapor should be snuffed into the nose. It probably acts, as already explained, by setting free ozone. The pollen of plants, the presence of which gives rise to the symptoms of hay-asthma, is destroyed. The offensiveness of an *ozœna* may be removed by the same expedient. *Chronic nasal catarrh* may not unfrequently be greatly benefited by the vapor of bromine.

The most important use of bromine is as an escharotic. For the destruction of *chancre*, it is probably the best caustic. *Hospital gangrene*, the experience of the rebellion demonstrated, was more certainly arrested by bromine than by any other escharotic.

For the destruction of *carcinoma uteri*, this agent is preferred by some eminent gynæcologists. When used for these purposes pure bromine is applied, by means of a glass rod, thoroughly, to the diseased or sloughing or gangrenous surface.

The objections to the use of bromine are its fetid odor, its volatility (boils at 117° Fahr.), and the pain which attends its escharotic action.

Acidum Carbolicum.—Carbolic acid. *Phénique acide*, Fr.; *Carbolsäure*, Ger. "Is either in acicular crystals, or in crystalline masses; white or colorless when perfectly pure, but, even when slightly impure, either reddish or becoming so on exposure; deliquescent and readily assuming the liquid state in the presence of a little water, yet not dissolving; of a strong odor and taste, recalling those of creosote, but distinct; fusible at from 93° to 106°, forming an oily liquid. It is soluble in from twenty to thirty-three parts of water, the purest being most soluble. Alcohol, ether, glycerine, and the essential oils, dissolve it freely. It combines with alkalies and other salifiable bases, but its compounds have still an alkaline reaction and are decomposed by the feeblest acids, even by carbonic acid." Dose, gr. ¼—gr. j.

Acidum Carbolicum Impurum.—Impure carbolic acid. "Is either colorless or has a brown shade. It consists of carbolic and cresylic acids, in variable proportion, with impurities derived from coal-tar, which vary from ten to thirty per cent."

Glyceritum Acidi Carbolici.—Glycerite of carbolic acid (℥ ij carbolic acid; half a pint of glycerine).

Aqua Acidi Carbolici.—Carbolic-acid water (glycerite of carbolic acid, ʒ x; water, one pint). Dose, a teaspoonful to a half-ounce.

Unguentum Acidi Carbolici.—Ointment of carbolic acid (ʒ j—℥ j).

Creosotum.—Creosote. "A colorless, oily, neuter liquid, having a strong, characteristic odor, and an acrid, burning taste. Is sparingly soluble in water, but mixes in all proportions with alcohol and ether.

"It is distinguished from carbolic acid, which it in some respects closely resembles, by not coagulating collodion when mixed with it, and by not imparting a blue color to a slip of pine-wood dipped first into an alkaline solution of creosote, and then, after drying, into muriatic acid."

Aqua Creosoti.—Creosote-water (ʒ j—Oj). Dose, a teaspoonful to an ounce.

Carbolic acid has entirely superseded creosote as a remedy.

ANTAGONISTS AND INCOMPATIBLES.—Combination with alkalies diminishes, but does not entirely check, the physiological activity of carbolic acid. Saccharate of lime, or lime, is probably the most efficient antagonist from the chemical point of view (Th. Husemann). In cases of poisoning, this substance should be given freely. There is no chemical or physiological antidote to carbolic acid after absorption has taken place. Hence toxic symptoms should be treated on general principles as they arise. The local caustic action is lessened by vegetable demulcents, but not by oils and glycerine.

SYNERGISTS.—All corrosives and antiseptics, from the physiological standpoint, favor the action of carbolic acid.

PHYSIOLOGICAL ACTIONS.—Carbolic acid coagulates albumen, and dissolves in volatile and fixed oils. Applied to the integument or mucous membrane it produces a burning sensation of short duration, and a whitish eschar, which subsequently becomes brownish, is formed. It lowers the sensibility to pain and touch of the part to which it is applied, and insensibility to pain may be sufficiently induced to permit free incisions without suffering (Bill, Andrew Smith). Its escharotic action, which, however, is very superficial, is due to its power to coagulate albumen and to combine with fats.

Carbolic acid is very destructive to the lower forms of life—bacteria, vibrio, fungi, etc. These minute organisms cease to exist when very dilute solutions of this agent are brought into contact with them. As all fermentations are correlative of the growth and multiplication of these minute bodies, carbolic acid, by destroying their activity, arrests zymosis. Ordinarily a solution one per cent. in strength is sufficient to destroy bacteria, vibrio, etc. (Neumann).

Applied to the external integument carbolic acid is absorbed, and systemic effects follow, the urine becoming smoky. Fatal poisoning has resulted from such applications (Köhler).

Carbolic acid has a cooling, sweetish taste, followed by heat and pungency. It acts on the mucous membrane as on the skin, and, in cases of poisoning by the stomach administration, eschars at first whitish and afterward becoming brown or black, and surrounded by a zone of inflammatory redness, are found. In suitable medicinal doses a cooling sensation, followed by warmth, is produced. In toxic doses the local symptoms are those caused by an irritant poison. Carbolic acid, notwithstanding its power to coagulate albumen, rapidly diffuses into the blood. A case has been reported in which an ounce proved fatal to a male adult within three minutes, and a number of cases have occurred in which death ensued within an hour after the ingestion of a half-ounce to an ounce (Taylor). Carbolic acid exists in the blood, probably, as a carbolate. The blood itself does not appear to be altered; at least no change in its corpuscular elements has been discovered on microscopical examination. Added to blood outside of the body, carbolic acid produces very positive effects. The action of the heart and the blood-pressure are, apparently, not affected by carbolic acid. The influence which it has on temperature seems equally negative, although it has been stated that the fever-heat of putrid infection is diminished by it (Erls).

The respiration is increased in frequency, both before and after division of the vagi, whence it may be concluded that carbolic acid stimulates the respiratory centre and the peripheric nerve-endings (Salkowski). By the systemic administration, carbolic acid does not destroy the conductivity of nerves or the contractility of muscles; but, locally applied, it suspends the functions of the sensory nerves. Stupor, insensibility, and convulsions, are produced by carbolic acid, and these effects are due to the direct impression of the agent on the cerebral lobes. In animals carbolic acid, in lethal doses, causes muscular weakness, insensibility, and convulsions (Rothe).

Carbolic acid is in part consumed in the body, and the products of its combustion are excreted in the urine, whence the smoky, blackish appearance of that excretion. In part, carbolic acid is eliminated by various excretions—by the lungs, skin, and kidneys—and, probably, for the most part in combination with a base.

THERAPY.—*Nausea and vomiting*, due to an irritable state of the stomach-nerves, is relieved by carbolic acid. Combination with bismuth enhances the effect. ℞. Acidi carbolici, grs. iv; bismuthi subnitrat., ʒ ij; mucil. acaciæ, ℥ j; aquæ menth. pip., ℥ iij. M. S. *A tablespoonful every two, three, or four hours.* Attacks of *cholera-morbus* and *cholera infantum* are not unfrequently very promptly arrested by the exhibition of carbolic acid, or the combination of carbolic acid and bismuth. *Eructations of gas*, due to the fermentation of foods, and the vomiting of yeast-like matters, especially when due to the presence of *sarcina*, are often arrested by this remedy. Good results have been obtained by the use of carbolic acid in *Asiatic cholera.* Combination with iodine is said to be more effective (Choleratropfen). ℞. Acidi carbolici, grs. iv; tinct. iodinii, gtt. xvj; aquæ menth. pip., ℥ iv. M. S. *A tablespoonful every hour, or oftener.* The same formula has been used successfully in *cholera nostras* and *cholera infantum* (Rothe).

Based on its power to arrest the action of ferments, carbolic acid has been used, with certainly temporary good results, in *diabetes* of hepatic origin (Ebstein, Habershon).

Inhalations of carbolic-acid spray possess a high degree of utility in *chronic nasal catarrh*, *hay-asthma*, *chronic bronchitis*, and *whooping-cough.* A solution in water, to the proportion of one per cent., is a suitable solution for this purpose. It may be combined with the tincture of iodine. The efficacy of these inhalations in hay-asthma and in whooping-cough is probably due to the fact that carbolic acid destroys the minute organisms (cacobacteria, pollen), on the presence of which the morbid action in these maladies depends (Letzerich). The vapor of carbolate of iodine may be inhaled in these diseases. The warmth of the hand suffices to vaporize a mixture of carbolic acid and tincture of iodine.

In *pulmonary phthisis*, when there is much teasing cough, or when expectoration is profuse and foul-smelling, these inhalations are serviceable. In *gangrene of the lung*, carbolic spray and the acid internally are used to destroy the fetor. A one-per-cent. solution of carbolic acid and a mixture of carbolic acid and iodine have been injected with asserted advantage into *phthisical cavities* through the parietes of the thorax.

Influenced by theoretical considerations, carbolic acid has been much prescribed by some practitioners in *diphtheria*, *scarlet fever*, *variola erysipelas*, *typhoid*, etc. Experience has not confirmed the truth of the theory on which this practice is based. The morbid process set up by the disease-germs is not arrested in its course by an antiferment. Local applications to the fauces of carbolic-acid spray or solutions are useful in diphtheria and scarlet fever, to remove fetor and to destroy such disease-germs as are generated at this point; but it is not possible to introduce into the blood with safety a quantity of carbolic acid sufficient to arrest zymosis at distant points, admitting the existence of a morbid process comparable to the process of fermentation. Mr. Lister concludes that a strength of one to forty of carbolic-acid spray or solution is necessary in order to prevent the infection of wounds, by atmospheric germs, during the progress of surgical operations.

Parenchymatous Injection of Carbolic Acid.—The deep-seated injection of carbolic acid has been proposed and successfully practised for the relief of various morbid states. For this purpose a two-per-cent. solution is most suitable. A solution stronger than this may excite inflammation in the part and coagulate the blood. It is directed by Hüter that the needle of the hypodermic syringe be first inserted into the inflamed part, and, if no blood flow out through the needle, it will be known that a vein has not been penetrated. From twenty to thirty minims of the solution are then injected. The injections are made once or twice a day in acute diseases, and on alternate days, or less frequently, in chronic cases. Very remarkable results have been obtained from these injections in *erysipelas* (Hüter, Aufrecht) and in *pleuro-pneumonia* (Kunze).

Dr. Tessier, of the Mauritius, reports that *intermittents* are rapidly cured by the injection of three-quarters of a grain of carbolic acid dissolved in twenty minims of water.

The parenchymatous injection of carbolic acid is more especially adapted to the treatment of certain surgical maladies. Hüter has employed this method successfully in *lupus*, *chancroid*, *secondary syphilitic abscesses*, *ulcerations*, *synovitis* (injected into the affected joint), *fistulæ*, *enlarged bursæ*, *hydrocele*, etc.

Local Application of Carbolic Acid.—*Itching of the skin*, arising from any cause, is allayed by sponging the part with a solution of carbolic acid. ℞. Acid. carbol., ʒij; glycerini, ℥j; aquæ rosæ ad ℥viij. M. Sig. *Lotion.* This application is especially serviceable in *prurigo* and *prurigo senilis.* Carbolic acid is an effective application in parasitic skin-diseases—*pityriasis versicolor, tinea tonsurans, tinea circinata, favus, scabies*, etc. ℞. Acid. carbol., ʒj; glycerini, ℥j. M. S. *Local application for parasitic skin-diseases.* The internal administration of carbolic acid should be conjoined with its local use in *prurigo, chronic eczema*, and *sycosis parasitica.*

The following is an efficient local application for *chilblains:* ℞. Acid. carbol., ʒj; tinct. iodinii, ʒij; acid. tannici, ʒij; cerat. simplicis, ℥iv. M. Sig. *Ointment.*

Undiluted carbolic acid is used as a mild escharotic to the so-called *mucous patches*, to *condylomata, vegetations*, etc., *lupus, scirrhus, cauliflower-growths*, etc. The author has witnessed results which appear to him to justify the statement that carbolic acid, applied undiluted to the cancerous sore and injected underneath, limits the extension and retards the growth of the disease.

Undiluted carbolic acid is an efficient application to *ulcers of the cervix uteri, chronic endo-cervicitis*, and *endo-metritis.* It may be applied undiluted without risk to the mucous membrane of the uterine cavity, on the cotton-wrapped probe, after preliminary dilatation of the canal. There is, probably, no better means of treating uterine catarrh.

Solutions of carbolic acid, of adequate strength, have the power to check *suppuration*, and to correct the *fetor* of sloughing and ill-conditioned wounds. The methods of Mr. Lister's antiseptic treatment include a much more extended application of carbolic acid. Embracing the fermentation theory of M. Pasteur, Mr. Lister holds to the necessity of excluding germs from contact with wounded surfaces. Operations by the method of Mr. Lister must be performed under and in a spray of carbolic acid (one part to forty). The solution may be pulverized by the ordinary hand-ball atomizer, or better by a Siegle's steam atomizer. All knives, sponges, and ligatures, must be "carbolized" before coming into contact with the wounded surface. The antiseptic dressing is thus described by Mr. Lister: "It consists of two pieces of folded gauze and mackintosh (fine cotton cloth with a layer of caoutchouc), an anterior and a posterior one. The wound is covered with several thicknesses of gauze dipped in a solution of carbolic acid (one to forty), and over this is placed the folded gauze and mackintosh, of sufficient size to extend beyond the margins of the wound in all directions." The dressing is confined by turns of a "gauze bandage," and is allowed to remain undisturbed for from two days to a week, "the general rule being that the dressing should be changed on any day on which the discharge is observed to have extended beyond the edge of the folded gauze."

Antiseptic gauze consists of cotton cloth charged with the following: "One part of crystallized carbolic acid, five parts of common resin, and seven parts of solid paraffin"—the paraffin and resin are first melted together, and the acid is then incorporated by stirring. A very complicated process, too elaborate for insertion here, is described by Mr. Lister, for diffusing the above-described mixture equably through the cotton cloth. For lubricating instruments, especially catheters and bougies, he advises a solution of one part of carbolic acid in twenty parts of olive oil. Carbolized silk sutures are "prepared by immersing a reel of the silk in melted beeswax, mixed with about a tenth part of carbolic acid, and drawing the thread through a dry cloth as it leaves the liquid, to remove superfluous wax."

The following is the University College formula for the preparation of carbolic-acid plaster: "Shellac, 75; carbolic acid, 25. Melt the shellac with 8 of the acid, and then add the remaining 17, and mix thoroughly. The mixture should be spread on linen, and should be coated with a solution of gutta-percha in bisulphide of carbon."

The admirable results in the treatment of wounds obtained by Lister have been fully confirmed by various competent observers (Nussbaum, Thiersch, Volkmann, Bardeleben), and, although objectors have risen to deny the superiority of the method, it has been shown that the ill-success complained of was due to inattention to the various details necessary.

Carbolic acid enters into the composition of Morrell's antiseptic fluid, which is used as a disinfectant for general purposes, and for the preservation of bodies. The following is the formula: "Dissolve 13.5 parts of arsenious acid and 6.9 parts of sodic hydrate in 15 to 20 parts of water; add enough carbolic acid until the clear fluid, after stirring, appears turbid (that is, until the liquid is fully saturated with carbolic acid), and dilute with water to make 100 parts."

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Salicin.—A neutral principle—a glucoside—contained in the bark of several species of salix, and of other trees and plants. It crystallizes in plates or in the rhombic system, is whitish in color, bitter to the taste, and neutral in reaction (Husemann). It is sparingly soluble in water. Dose, grs. v—grs. xxx.

ACTIONS AND USES.—Salicin promotes appetite and the digestion—properties which it possesses in common with other bitters. It is an antiferment, and has antiseptic powers similar to quinia and salicylic acid. The latter is a derivative of salicin. It is destructive to bacteria and vibrio, and prevents the reaction of amygdalin and amulsin, and of ptyaline on starch. It does not produce very sensible effects even in large doses, and is without toxic activity. It has been used as a substitute for quinia in the cases of disease to the treatment of which the latter is applied, especially in the treatment of *intermittents*. It is, however, much inferior to quinia.

Salicin is an excellent stomachic tonic in *atonic dyspepsia*, and is a serviceable remedy to prevent the fermentations which take place in the foods in cases of *gastro-intestinal catarrh*. In the *chronic diarrhœa* of children, it has been employed successfully. The good results obtained from it in these cases are doubtless due to its antiferment properties and its lack of irritating qualities.

The most important use of salicin thus far proposed is in the treatment of *acute rheumatism*—information which we owe to Dr. Maclagan. He concludes, as the result of his experience, that the more acute the case the more beneficial the remedy; that the good effects are always experienced within forty-eight hours; that, sometimes, the disease is at once arrested; that relief of pain and fall of temperature are the earliest effects produced. Maclagan gives from ten to thirty grains every two, three, or four hours, in powder mixed with water. "Fifteen grains every three hours is a medium dose."

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Acidum Salicylicum.—Salicylic acid (unofficinal). *Acide Salicylique*, Fr.; *Salicylsäure*, Ger.

Properties.—Salicylic acid crystallizes in needle-shaped crystals, which are soluble in alcohol and ether, and in hot but not in cold water. It is without smell, and its taste is slight and not disagreeable. The solubility of salicylic acid in cold water is increased by the presence of neutral salts. Three parts of phosphate of sodium will render one part of the acid easily soluble in fifty parts of water. Borate of sodium is still more efficient in promoting the solubility of the acid, and, as boracic acid has properties corresponding to salicylic, the borate should be preferred for this purpose. It has been shown that ten parts of salicylic acid can be dissolved in one hundred parts of water, by the addition of eight parts of borax (Bose). The borax should be first dissolved by the aid of heat, and the salicylic acid should be added gradually to the hot solution of borax. On cooling, filtration is necessary to separate a small quantity of undissolved residue.

The dose of salicylic acid for internal administration ranges from ten grains to one drachm.

Sodii Salicylas.—Salicylate of sodium. Dose, grs. xv— ʒ j. The solution of salicylate of sodium is brownish in color, and unpleasant to the taste. Extract of liquorice, it is said, covers the taste somewhat.

Antagonists and Incompatibles.—As regards external uses, salicylic acid loses its antiseptic property by combination with alkalies (Kolbe).

Synergists.—All those agents which possess the power to destroy disease-germs are synergistic—notably carbolic, boracic, and benzoic acids.

Physiological Actions.—Applied to wounds in a pure state, salicylic acid causes pain and irritation, but, in the strength usually employed for this purpose, it does not have these effects. It has the power to prevent fermentations and putrefactive decomposition. It is very destructive to the minute organisms on the presence of which these fermentations depend (Kolbe, Letzerich). Its powers, in these respects, seem greater than those of carbolic acid (Thiersch). A minute quantity will arrest the vinous fermentation, and prevent decomposition of animal fluids. In consequence of the possession of these properties, salicylic acid favors primary union of wounds, lessens suppuration, and prevents septic infection.

Salicylic acid appears to be devoid of toxic power. In suitable doses it does not produce gastric irritation, but the salicylate of soda in large doses is apt to cause nausea and vomiting. Kolbe took from fifteen to twenty grains daily of salicylic acid without any disturbance of his functions. Salicylic acid probably combines with the soda of the blood, and exists in that fluid as a salicylate. As it has been shown that the salts of salicylic acid do not possess antiseptic property, it is probable that the combinations formed in the blood do not affect the blood-corpuscles, but, as regards the action which this agent exerts after diffusion into the blood, nothing is definitely known.

It has been shown that, in the physiological state, salicylic acid does not affect the body temperature (Fürbringer); but the evidence is conclusive that in fevers it is an antipyretic (Butt, Immermann, Senator, and others). Salicylate of soda in considerable doses (ʒj—℈iv), given on alternate evenings, exerts a very remarkable power over the temperature of fevers, depressing the heat from 2° to 3° C., and at the same time slowing the pulse. The decline of temperature usually persists for twenty-four hours, and is accompanied in about one-half of the cases with sweating (Moeli). Cerebral effects similar to those caused by quinia have also been observed, viz., giddiness, headache, tinnitus aurium, etc.

No increase of the urinary secretion has been noted. Elimination takes place chiefly by the kidneys.

THERAPY.—Salicylic acid will probably be found a useful addition to our resources for the treatment of *fermentations in the stomach*, for the destruction of *sarcina*, and as an enema for the removal of *ascarides*. The author is not aware, however, of any published observations on the use of this remedy in these affections, except those of Wagner, who commends its administration "in all cases where fermentative changes occur in the alimentary canal."

Very important results have been obtained from the use of salicylic acid as an antipyretic. In *typhoid*, *erysipelas*, *acute rheumatism*, *pneumonia*, *phthisis*, etc., it exercises a decided influence in lowering the temperature (Butt, Immermann, Senator). In these affections it is second only to quinia as an antipyretic. The trials of Senator have shown that salicylic acid possesses valuable antiperiodic power, and as a remedy for *intermittents* seems nearly if not quite equal to quinia. In five out of ten cases the cure was complete after one or two doses. In *diphtheria*, good results have been obtained by Letzerich and Wagner. The local application of a solution of salicylic acid may be conjoined in this disease with its internal administration. As the experiments of Furbringer have apparently shown that salicylic acid possesses a more decided antipyretic property in septicæmic fever than in essential or symptomatic fever, its use is indicated in *pyæmia*, *erysipelas*, *surgical fever*, etc.

Probably, in *acute rheumatism*, more than in any other malady, is salicylic acid effective. The observations which have been recently made show that this disease is not unfrequently arrested within forty-eight hours by the use of this remedy (Traube.) It removes the fever, quiets the articular pains, and reduces the swelling. Not every case is so favorably affected as to be arrested within forty-eight hours, but a remarkable influence appears to be exerted by this remedy over the course and duration of this disease.

As a *disinfectant* and *deodorizer*, salicylic acid, being free from odor, may take the place, to a large extent, of carbolic acid. For all toilet purposes it is to be preferred. It is an excellent addition to *dentifrices*, and its solution with borax is the most agreeable and efficient deodorant for *fetid perspirations*. Extraordinary success has been achieved by the local application of this remedy in *eczema of the head and face*. Those cases characterized by much weeping seem to be best adapted to the cure by salicylic acid, but *eczema rubrum* and *eczema impetiginodes*, that resisted other approved means, have yielded to the application of this agent (Wagner, Will). It is generally conceded that, as a local application to *syphilitic ulcers*, salicylic acid is inferior to carbolic acid.

The most important therapeutical uses of salicylic acid are in the antiseptic treatment of wounds and injuries. Since it has been shown that this agent has a power to destroy the activity of ferments and disease-germs equal to that of carbolic acid, while it is free from the irritating quality and disagreeable odor of the latter, Thiersch, who is a strong advocate for Lister's antiseptic method, has resorted to the use of salicylic-acid solutions.

To *cancer, gangrenous and sloughing wounds*, pure salicylic acid may be applied in powder. To prevent the contact and multiplication of atmospheric germs, operative procedures may be conducted in salicylic spray, the sponges and dressings may be saturated with salicylic solutions, and the wound may be irrigated by the same. In order to carry out all the details of the antiseptic method, salicylic acid is substituted for carbolic in the forms and combinations of dressings employed by Lister. Wounds are covered with cotton-wool, impregnated with an alcoholic solution of the acid, in the proportion of three and ten per cent. As cold water takes up only one part to three hundred, which, however, is strong enough to destroy bacteria, etc., the addition of borax is generally necessary to obtain a solution of sufficient strength for the antiseptic applications. A salicylic-acid plaster may be prepared as follows: Salicylic acid, ʒ ss—ʒ j; white wax, ʒ j; paraffine, ʒ ij; almond-oil, ʒ ij. The ingredients are melted, and rubbed up together in a heated mortar (Will), and spread on muslin. An ointment more readily melted by the heat of the body is the following: Sperm-oil, ʒ jss; cacao-butter, ʒ vss; salicylic acid, ʒ ss—ʒ j. This should be melted together, thoroughly incorporated and spread on lint (Will). An ointment for the same purposes may be prepared in a simpler way by the addition of salicylic acid to simple cerate. A solution of salicylic acid in olive-oil, in the proportion of one drachm to eight ounces, is an efficient local application for *burns*.

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Will, Dr. J. C. Ogilvie. *On Salicylic Acid. The Lancet*, vol. ii., 1875, p. 870, *et seq.*

Acidum Boracicum.—Boracic acid. *Acide boracique*, Fr.; *säure*, Ger.

Properties.—Boracic acid occurs in glittering, white, scaly crystals. It is soluble in twenty-six parts of cold, and in three parts of warm water, and is freely soluble in alcohol.

Actions and Uses.—Boracic acid possesses decided antiseptic and deodorant properties. It arrests fermentations and putrefactive decomposition, and is destructive of minute organisms—bacteria, vibrio, etc. Applied to wounds, it is free from irritating effects; it lessens suppuration, and prevents decomposition.

Boracic acid occupies an important place in Lister's antiseptic method. It appears to be as effective as carbolic acid, and is even less irritating to the tissues than salicylic acid. A saturated solution may be employed as a dressing to fresh wounds to prevent the action of atmospheric germs, or to arrest decomposition in gangrenous, sloughing, or ill-conditioned wounds. "Boracic lint" is made by steeping lint in a saturated solution of boracic acid at the boiling-point; and, after drying, it is found to hold a large quantity of the acid, weighing nearly twice as much as before being thus treated.

Mr. Lister's directions for the application of boracic-acid dressings to *ulcers* are as follows: "The first step is to cleanse the sore and the surrounding skin once for all from septic impurity. This is done by treating the surface of the sore freely with a solution of the chloride of zinc (forty grains to the ounce); and at the same time washing the integument with a strong watery solution of carbolic acid, which is used on account of its remarkable power of penetrating the epidermis, while for the sore itself the solution of the chloride appears to be more efficient. This preliminary step having been taken, the boracic dressing is at once employed as follows: A piece of oiled-silk protective, of sufficient size to cover the sore and slightly overlap the surrounding skin, is dipped in the boracic lotion (a saturated, watery solution) and applied, and over this a piece of boracic lint large enough to extend for an inch or more beyond the protective on all sides, the whole being retained in position with a bandage."

Mr. Lister has used boracic solutions with great success in *pruritus ani*, *ulcers*, *skin-grafting*, *burns* and *scalds*, *eczema*, in *operations on the penis*, etc. By Mr. Watson, these solutions have been employed with excellent results in the dermatophyta; for example, *tinea tonsurans* and *t. circinata*—especially "in that very troublesome form of the disease which affects the scrotum and inner side of the thighs."

Boracic ointment may be made as follows: "Take of boracic acid finely levigated one part; white wax, one part; paraffin, two parts; almond-oil, two parts. Melt the wax and paraffin by heating them with the oil, and stir the mixture briskly along with the boracic-acid powder in a warm mortar until the mixture thickens." When required for use, this ointment should be rubbed up with a little glycerine to the proper consistence, and then spread on muslin or linen.

Boracic acid may be employed in all the various forms and combinations in which carbolic and salicylic acids are now used by the antiseptic method.

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HUSEMANN, DR. THEODOR. *Handbuch des gesammten Arzneimittellehre*, erster Band, p. 284.

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Benzoinum.—Benzoin. A solid balsam obtained from styrax benzoin. *Benjoin*, Fr.; *Benzoëharz*, Ger.

COMPOSITION.—Benzoin is made up of resins. When subjected to dry distillation it yields *benzoic acid*, which is contained in it in the proportion of fourteen to eighteen per cent. Certain varieties of benzoin contain, also, *cinnamic acid.*

Tinctura Benzoini.—Tincture of benzoin (℥vj—Oj). Dose, ʒss—ʒj.

Unguentum Benzoini.—Ointment of benzoin. (Tincture, ℥ij; lard, ℥xvi.)

Tinctura Benzoini Composita.—Compound tincture of benzoin. (Benzoin, socotrine aloes, storax, balsam of tolu, alcohol.) Dose, ʒss—ʒij.

Acidum Benzoicum.—Benzoic acid. "Is in white, feathery crystals, of a peculiar, agreeable odor, and warm, acidulous taste, sparingly soluble in cold water, more soluble in boiling water, which deposits it in part on cooling, and very soluble in alcohol."

Ammonii Benzoas.—Benzoate of ammonia. "Is in minute, white, shining, thin, four-sided, laminar crystals, with a slight odor of officinal benzoic acid, and a bitterish, saline, somewhat balsamic taste, and slightly acrid, but persistent after-taste. It is soluble in water and alcohol." Dose, grs. v—ʒ ss.

ACTIONS AND USES.—The physiological effects of benzoin and its preparations are due to benzoic acid. Taken in very considerable doses (ʒ ss) benzoic acid produces some epigastric heat, increases the pulse-rate, and promotes bronchial and cutaneous transpiration. The acidity of the urine is rendered more decided by it. A large part of the acid is excreted by the kidneys as benzoic acid, and a part undergoes conversion into hippuric acid.

Recent observations have shown that benzoic acid has decided antiseptic properties (Salkowski). It manifests the same power to prevent fermentations and putrefaction, and to destroy minute organisms, possessed by salicylic and boracic acids.

The tinctures of benzoin were formerly used as expectorants in *chronic bronchial affections.* They are now sometimes resorted to for the local treatment (by atomization) of chronic laryngeal affections. Their most important use, however, is in the treatment of *foul-smelling wounds, flabby granulations,* etc. Unhealthy or sloughing wounds may be dressed with linen or cotton cloths saturated with the tinctures, with the effect to destroy fetor and stimulate to a more healthy growth. *Chapped hands and lips* and *fissured nipples* are best treated, according to Stillé, with a mixture of compound tincture of benzoin and glycerine. Benzoic acid may be used as a substitute for boracic and salicylic acids, in the antiseptic treatment of wounds. Its solubility in water can be increased by the addition of borax.

Benzoate of ammonia is a remedy of great utility when the *urine is ammoniacal and loaded with phosphates.* Under its use the urine becomes acid, and the fermentative changes are arrested. In *chronic cystitis,* arising from any cause, this remedy should be prescribed when the urine undergoes the alkaline fermentation. *Incontinence of urine,* when due to an alkaline reaction of this excretion, is cured by the benzoate of ammonia. *Phosphatic calculi* may be dissolved by the long-continued use of this remedy.

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FLÜCKIGER AND HANBURY. *Pharmacographia,* p. 361.
HUSEMANN, DR. THEOD. *Handbuch,* etc., zweiter Band, p. 996.
STILLÉ, DR. A. *Therapeutics and Materia Medica,* vol. ii., p. 574.

Antiseptic Oils.—*Oleum Caryophylli.* Oil of cloves.

COMPOSITION.—Oil of cloves consists of two substances—a hydrocarbon, *light oil of cloves,* and an oxygenated oil—*eugenol,* which has acid properties, and is therefore called *eugenic acid.* The light oil of cloves is isomeric with the oils of turpentine, copaiba, and cubebs.

Salicylic acid and a camphor known as *caryophyllin* are also constituents of the oil of cloves. Dose, gtt. ij—gtt. v.

Oleum Gaultheriæ.—Oil of gaultheria.

Composition.—Oil of gaultheria contains a hydro-carbon—*gaultherilen*, and an acid—*methysalicylic acid*, to which the acid reaction of the oil is due. Dose, gtt. v—gtt. xx.

Oleum Thymi.—Oil of thyme. "The volatile oil obtained from thymus vulgaris."

Composition.—Oil of thyme contains a hydro-carbon which, by fractional distillation, is resolvable into *cymene* and *thymene.* Its most important constituent is a solid crystalline substance, having acid properties and homologous with carbolic acid. This is known as *thymol*, or *thymic acid.* Dose, gtt. ij—gtt. x.

Oleum Cajuputi.—Oil of cajeput. "The volatile oil obtained from the leaves of melaleuca cajuputi." Dose, gtt. v—gtt. xx.

Composition.—The most important constituent of the oil of cajeput is *cajuputol*, or the bihydrate of *cajuputene.*

To this list might be added eucalyptol, the camphor obtained from eucalyptus globulus, and the various balsams, and cymene and terpene volatile oils; but these remedies have already been considered elsewhere, so far as they possess any practical importance.

Physiological Actions.—The composition of this group of oils indicates the close correspondence between them and carbolic, salicylic, and benzoic acids. So intimate are the chemical relations of salicylic acid, benzoic and cinnamic acids, that the balsams might with propriety be grouped with the antiseptics, for in their physiological actions and therapeutical applications they are equally as closely related as in their elementary composition.

Of the members of this group, thymol or thymic acid has been most elaborately studied. Lewin has shown that thymol, as respects its influence on fermentation and putrefaction, has a positive antiseptic property. Its actions are similar to those acids of the same class to which it is so closely allied chemically, viz., carbolic, salicylic, and benzoic. Locally applied, thymol, just as carbolic acid, produces paralysis of the end-organs of the sensory nerves (Lewin).

Therapy.—It has long been known that oil of cloves, and indeed the essential oils generally, have the power to relieve a painful state of a sensory nerve. Inserted into the cavity of an aching tooth, they suspend the pain. A solution of oil of cloves in rhigolene is a nostrum for the cure of superficial *neuralgiæ.* ℞. Ol. caryophylli, ol. gaultheriæ, ol. thymii, āā ʒj; tinct. benzoini, tinct. cinnamomi, āā ℥iv. M. S. *Apply on lint, and cover with oiled silk.* This prescription may be used to relieve pain in superficial nerves, or as a toilet article for the prevention of putrefactive fermentation in certain regions of the body (axillæ, pubes, feet).

The oil of cloves is the most effective deodorizer for sponge-tents hitherto employed.

The essential oils dissolved in alcohol (essence or tincture) are much used to correct *flatulence.* This action is doubtless due to two factors: to the antifermentative properties of the essential oils and the reflex muscular contractions which their presence in the intestinal canal excites.

Cajeput-oil has been used successfully in *cholera*, *cholera-morbus*, and *nervous vomiting.* ℞. Ol. cajuputi, ʒ j; spts. chloroformi, tinct. cinnamomi, āā ℥ j. M. S. *A teaspoonful every half-hour in glycerine or sirup and water.* As a parasiticide, cajeput-oil is an effective local application in parasitic skin-diseases—*scabies*, *tinea*, *pityriasis*, etc., and in the form of enema, in a suitable vehicle, against *ascarides vermiculares.*

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COUNTER-IRRITANTS.

EXTERNAL irritation, utilized for the relief or cure of internal maladies, is entitled *counter-irritation.* The remedies employed for this purpose are divisible into two groups:

1. Rubefacients;
2. Epispastics.

A *rubefacient* is a remedy which causes heat and redness; but, if the contact with the skin be sufficiently prolonged, vesication may be produced. An *epispastic* is a remedy which excites inflammation and vesication. The first group of remedies are restricted in their application to such therapeutical results as can be attained by a superficial and temporary action in the skin. The second group are intended for more permanent action and a deeper impression on internal organs. These remedies differ not only in the degree, but in the character of the effects produced. These differences will be more appropriately studied in connection with the remedies of each group.

RUBEFACIENTS.

Sinapis Alba.—White mustard. "The seed of sinapis alba."

Sinapis Nigra.—Black mustard. "The seed of sinapis nigra."

Charta Sinapis.—Mustard-paper.

COMPOSITION.—When water is added to pulverized black mustard, pungent, irritating fumes are given off. These fumes consist of the *volatile oil of mustard* (allyl sulphocyanide). This volatile oil is produced by a reaction between certain constituents of the seeds—*sinigrin* (myronate of potassium) and *myrosin*—in presence of water, and at a temperature below 100° Fahr. The boiling-temperature destroys the ferment, myrosin, and hence prevents the formation of the volatile oil. Mustard contains also a bland fixed oil, which may be procured by expression.

White mustard contains an indifferent, crystalline substance, *sinalbin*, and *myrosin.* Sulpho-cyanate of acrinyl, a product of the reaction between sinalbin and and myrosin, is the rubefacient principle of white mustard (Flückiger and Hanbury). White mustard contains also an alkaloid—*sinapine.* The chemical compositions of the two kinds of mustard are, it will be seen, closely analogous. Myrosin exists in white mustard in larger proportion than in black, hence a considerably larger quantity of the volatile oil of mustard is formed, when an addition of white mustard is made to the black.

Emplastrum Arnicæ.—Plaster of arnica (extract of arnica, resin-plaster).

Emplastrum Picis Burgundicæ.—Burgundy pitch-plaster (Burgundy pitch, yellow wax).

Emplastrum Picis Canadensis.—Canada pitch-plaster (Canada pitch, yellow wax).

Emplastrum Picis cum Cantharide.—Plaster of pitch with cantharides (Burgundy pitch, cerate of cantharides).

Linimentum Ammoniæ.—Liniment of ammonia (water of ammonia, ℥ j; olive-oil, ℥ ij).

Linimentum Camphoræ.—Liniment of camphor (camphor, ℥ iij; olive-oil, ℥ xij).

Linimentum Saponis.—Soap-liniment (soap, ℥ iv; camphor, ℥ ij; oil of rosemary, ℥ ss; water, ℥ vj; alcohol, Oij).

Linimentum Terebinthinæ.—Liniment of turpentine (resin-cerate, ℥ xij; oil of turpentine, Oss).

Firing.—The application of heat by Mayer's hammer.

An excellent rubefacient for long-continued use and moderate activity is the domestic *spice-bag.* This consists of a mixture in equal parts of cloves, cinnamon, allspice, ginger, and a half-pint of capsicum, sewed into a flat bag. When required for use, it is dipped in vinegar or whiskey, and laid over the affected region, usually the abdomen. A piece of flannel or spongio-piline may be moistened with the tincture of these aromatics, and applied for the same purposes.

A *turpentine-stupe*, which is one of the most frequently-used extemporaneous counter-irritants, is made as follows: A piece of flannel folded in several layers, or a piece of spongio-piline, is wrung out in hot water, and a few drops (five to fifteen) of turpentine are sprinkled over it. This is placed over the affected region, and is confined by a towel or napkin pinned around the part. Turpentine, applied in this way, is a very active rubefacient, and may even vesicate, so that attention is required to avoid overaction.

EPISPASTICS.

Ceratum Cantharidis.—Cantharides or blistering cerate.

Ceratum Extracti Cantharidis.—Cerate of extract of cantharides.

Charta Cantharidis.—Cantharides-paper.

Collodium cum Cantharide.—Collodion with cantharides.

Linimentum Cantharidis.—Liniment of cantharides. (Turpentine and cantharides.)

Of the above preparations the most efficient is the *ceratum extracti cantharidis*, the most elegant the *charta cantharidis*, and the most convenient the *collodium cum cantharide.* The cerates should be spread on adhesive plaster, leaving a margin of the plaster to secure adhesion to the skin. Before the application of a blister, if prompt action is necessary, a mustard-plaster should be laid on long enough to produce rubefaction, or the skin should be rubbed with turpentine. When the skin is very thin and sensitive, the blister should be covered with tissue-paper. When the vesication is to be permitted to heal in a short time, or when young and irritable subjects are to be blistered, the cantharides-plaster should be removed when distinct redness of the skin is produced, and a poultice applied, which will develop the vesicles. The length of time required for a blister "to draw" is influenced by the age of the subject and the condition of the skin. From two to twelve hours, as a rule, will elapse before vesicles appear; and, when a very deep impression is intended, the blister may remain even twenty-four hours. In infants and in certain states of the constitution (scorbutus, purpura, scarlatina, etc.), prolonged contact of a cantharides-plaster may cause deep sloughing and very severe nervous symptoms, and adynamia.

When the vesicles are fully developed, they should be punctured at the most dependent point, and the serum, as it escapes, absorbed by a soft cloth. If the blistered surface is to be allowed to heal, a dressing of raw cotton suffices. If discharge is to be encouraged, resin-cerate or savine-cerate may be applied spread on a cloth perforated to permit the discharge to exude and covered with raw cotton to absorb the fluid. If the blister is slow to heal, boracic-acid lotion is an efficient application, or a weak lead-lotion may be used.

THE THEORY OF COUNTER-IRRITATION.—When the skin is irritated, by a mustard-plaster, for example, the superficial vessels of the part dilate, and an increased amount of blood is present in them. For a short distance around the part irritated, also, more or less dilatation of the vessels takes place. In this way a small amount of blood may be temporarily imprisoned. The influence which the retention in an external part of so small an amount of blood has, on the general circulation, must be very slight. The obvious relief often afforded by a mustard-plaster can hardly, therefore, be ascribed to this limited withdrawal of blood.

An irritation established in the neighborhood of a part in which a morbid action is proceeding may, by reason of the contiguity of the tissues, affect the vascular supply to the diseased textures. *Ubi irritatio, ibi fluxus;* but, in order that the fluxion shall modify diseased action, it is necessary that there be a continuity of the vascular connections. The method of Furneux Jordan, which consists in the application of the counter-irritant to the neighboring vascular area, is based on this principle.

An irritation which consists in a local fluxion, and a state of altered sensibility in the nerves of the part, may affect the functions of distant organs. Counter-irritation applied to a considerable surface increases the action of the heart, raises the temperature of the body, and exalts the irritability of the nervous system. These are the general or systemic effects. Distinctly-localized results are also produced. When one hand is immersed in cold water, a positive fall of temperature takes place in the other. Irritation of the lumbar region, as Brown-Séquard has shown, is followed by contraction of the vessels of the kidneys. Extensive injury to the surface of the body, by burning or scalding, may excite ulcerative action in the duodenum, or may set up a pneumonia. Injury to a motor-nerve trunk may be followed by ascending neuritis, and serious atrophic changes in the multipolar ganglion-cells of the anterior columns.—It follows from these facts that an irritation of the surface which involves the end-organs of the nervous system will affect the calibre of the arterioles and modify the functions of the trophic nerves. In these results we find a rational explanation of the *methodus medendi* of counter-irritation.

Certain other physiological laws deserve attentive consideration in this connection. An irritation which first produces a tetanic state of the vaso-motor nervous system may, if too long continued, exhaust the irritability of the organic muscular fibre, and cause paresis. Moderate irritation will exalt the functional power of the trophic centres; but excessive and long-continued injury to the surface may set up atrophic changes (ulcer of duodenum from burn). In these physiological facts also we find a rational explanation of the injury not unfrequently done by too powerful or too protracted counter-irritation.

Vesicants, in addition to the effects of counter-irritants sketched above, cause an exudation of serum. This exudation may have a twofold effect: 1. To lessen the gross amount of the blood-serum, and thus diminish the blood-pressure; and, 2. To remove toxic or pathological materials from the tissues and fluids of the inflamed part. More powerful systemic effects are produced, and vaso-motor paresis and trophic changes are more quickly induced by blisters than by rubefacients.

THERAPY.—Various methods of counter-irritation are employed in the treatment of diseases of the abdominal viscera. For the relief of *nausea*, *vomiting*, *diarrhœa*, *colic*, *cholera-morbus*, etc., no expedient is more generally useful than a mustard-plaster. In *persistent vomiting*, a small blister applied to the epigastrium will often afford permanent relief. The good effects of a blister in such cases are enhanced by dusting over the exposed derma some powdered morphia. In acute inflammatory affections—*typhlitis*, *peritonitis*, *puerperal peritonitis*, *pelvic cellulitis*, etc.—the best results are obtained by the use of turpentine-stupes during the acute stage, and the application of blisters after the acuter symptoms have subsided. The prolonged contact of blisters with the abdominal wall of thin subjects has set up peritonitis by contiguity of structures. The author has observed instances of this kind, and analogous cases have been reported.

In chest-diseases—*pleuritis*, *pneumonia*, *pericarditis*, etc.—some form of counter-irritation is invariably employed, and is often greatly abused. At the onset of these maladies a large mustard-plaster to the chest, allowed merely to redden the skin, is an excellent expedient; during the progress of the inflammation the turpentine-stupe is generally the best application; to assist in the process of resolution and repair, the more permanent action of a blister will be serviceable. Much has been said about the "blistering-point" in pneumonia. The discussion is resolvable into this: during the inflammatory stage, blisters are harmful, because they stimulate the nervous and vascular system, and are useful when the crisis occurs, to assist in the liquefaction and absorption of inflammation products. At the very inception of an acute thoracic disease a flying blister may render the same service as a mustard-plaster, but it possesses no advantage over the latter. A succession of "flying blisters" appears to be useful in *hydrothorax*, to promote absorption.

Counter-irritants are much abused in the treatment of *phthisis* at its various stages. The chest-pains which accompany this disease can usually be relieved by mustard and belladonna plasters. Intercurrent attacks of pleuritis and pneumonia may be treated by the milder forms of irritation. The pustulation of the chest with croton-oil or tartar-emetic ointment is rarely if ever justifiable, and deep blistering is always harmful.

In *acute inflammation of the meninges*, *cerebral or spinal*, blisters are often employed, but there is singularly little proof of their utility When used they should be confined to the mastoid processes or to the nape of the neck. Under no circumstances is it ever justifiable to shave and blister the scalp, as was formerly not unfrequently done in various forms of cerebral disease. An *aura* proceeding from an extremity may be intercepted, and attacks of *epilepsy* averted, by encircling the limb with a strip of blistering-plaster. Various instances of the success of such a blister have been reported. *Hysterical paralysis* is most successfully treated by encircling the affected extremity with narrow blisters (Reynolds), and *hysterical aphonia* may sometimes be very quickly cured by a blister to the larynx. The curative effect of such an application is doubtless due to the moral impression of the counter-irritant. Blisters over the course of the affected nerve are of great service in *neuritis.* The good effect of the blisters is increased by treating the blistered surface with morphia. There can be no doubt of the curative value of blisters in *neuralgiæ.* According to Anstie, it is not the mental impression produced by the pain of the blister, and not the withdrawal of serum from the focus of pain, which explain their efficacy, but they act "as true stimulants of nerve-function." The best point at which to apply the blister is "as close as may be to the intervertebral foramen from which the painful nerve issues." Flying blisters are to be preferred, and, as a rule, exudation of serum is not to be encouraged.

Lumbago, *myalgia*, and fugitive but recurring muscular pains, are sometimes relieved by the warming plasters given at the head of this article, or by frictions with ammonia-liniment, turpentine-liniment, etc.

Blisters are, as a rule, inadmissible in acute affections of the kidneys and bladder. A succession of blisters to the perinæum is unquestionably serviceable in *chronic prostatitis* and in *gleet.*

Inflammatory affections of the eye and ear are, as a rule, benefited by the application of blisters in the neighborhood of these organs.

The application of blisters is an effective method of treating *acute rheumatism.* According to the plan of Davies and Dechilly, the affected joints are enveloped in blisters, which are allowed to remain until thorough vesication is produced and serum is abundantly discharged. The author, who has had considerable experience in the treatment of rheumatism by this method, finds that a number of small blisters applied around the joint are as effective and less painful. The good effects of the blister-treatment are these: the pain and swelling are abated, the danger of cardiac complication lessened, and the duration of the disease shortened. It is a singular fact that the urine becomes neutral or alkaline under the action of blisters. The curative effect of blisters is not, probably, to be ascribed to the withdrawal of acid serum from the affected joints, but rather to an influence exerted through the trophic nerves on the metamorphosis of tissues.

As general stimulants, rubefacients and vesicants are employed to arouse the vital processes in a condition of great depression or collapse from any cause, e. g., *cholera*, *pernicious malarial fever*, *uræmia*, *narcotic poisoning*, etc.

CONTRAINDICATIONS OF BLISTERS.—The acute stage of an inflammation; pregnancy; scorbutus and purpura; infancy; debility.

The strangury produced by blisters is lessened by the free use of diluent drinks, and is relieved when it occurs by an enema of laudanum or the hypodermatic injection of a minute quantity of morphia. A decoction of uva-ursi freely drunk will, it is said, prevent strangury, but the effect of this remedy is, probably, not greater than that of an ordinary diluent.

The method of "firing" is sometimes very beneficial in *neuralgia, spinal irritation, myalgia, etc.* The effects can be regulated by the temperature of the hammer, and by the duration of the contact with the skin, and may vary in severity from the mildest rubefaction to vesication, and even destruction of the skin.

ACUPUNCTURE.—Needles about three inches in length, and having a red wax, hard-rubber, or metal head, are employed for this purpose. They are introduced by a rapid rotatory motion. Insulated needles are used in the same way for conveying the galvanic current to deeply-placed nerves.

BAUNSCHEIDTISMUS.—This is a form of acupuncture, so named from Baunscheid, its inventor. "The instrument employed consists of a heavy disk, about half an inch in diameter, having inserted into it about twenty-five sharp needles, each about nine-sixteenths of an inch in length. To this disk a strong wire spiral spring (five and a half inches in length) is attached, and the other extremity of thé spring is inserted into an elongated spindle-shaped handle." The spring and needles are contained in a cylinder, the handle attached. The following is the mode of using it: the open extremity of the cylinder is placed firmly on the skin; the handle is then drawn up which compresses the spring; now, if suddenly loosed, the recoil of the spring drives the needles smartly into the skin. The punctures may be rubbed with a weak mixture of croton-oil, with cajeput-oil, or other suitable counter-irritant.

ACTIONS AND USES.—These are methods of counter-irritation which appear to possess peculiar powers. The theories which have been proposed to explain their mode of action are far from satisfactory. The method of Baunscheid is that of an ordinary counter-irritant added to the effects of acupuncture; but no explanation has hitherto been offered which accounts, in a rational manner, for the curative effects of acupuncture in certain maladies.

In *tic-douloureux*, *sciatica*, *lumbago*, and *myalgia*, it occasionally happens that remarkable and instantaneous relief is obtained by the insertion of acupuncture-needles.

When the patient is timid, the sensibility of the skin may be diminished by the application of chloroform for a minute, or of the ether-spray. If rapidly rotated by the finger and thumb, the needle will penetrate with little suffering.

AQUAPUNCTURE.—The method of aquapuncture consists in the introduction of water subcutaneously, or into the substance of muscles. A special instrument has been invented for this purpose, the advantage of which consists in its being armed with several needles, which permit the introduction of the water at various points simultaneously. Ordinarily, the hypodermic syringe will suffice for the performance of this little operation, and, if patients object to repeated punctures, the sensibility of the skin may be obtunded by ether-spray.

When water is injected under the skin, more or less pain, accompanied by burning, is produced. A wheal is formed about the site of the puncture, and redness of the skin and elevation of the temperature at that point follow. It is a remarkable circumstance that aquapuncture has the power to relieve pain in a superficial nerve. So decided is this effect that there are physicians who hold that the curative effect of the hypodermatic injection of morphia is due, not to the morphia, but to the water! In order that aquapuncture shall relieve pain, it is necessary that the water be injected into the neighborhood of the painful nerve. Injection at a remote and indifferent point would certainly fail of any effect except that reflex effect which is produced by any counter-irritant. Aquapuncture, however, has unquestionable power as a counter-irritant.

The method of aquapuncture has been employed with success, which must be regarded as extraordinary in *neuralgiæ*, facial, sciatic, and lumbo-abdominal; in *lumbago*, *irritability of the bladder*, *uterine colic*, *gastralgia*, etc. The author has produced excellent effects from the injection of water into *paralyzed* and *wasting muscles*. It promotes the nutrition of muscles, and contributes to the regeneration of voluntary power. In the various cases to which this treatment is applicable, the quantity which should be injected will vary from thirty minims to a drachm. When the first injection does not relieve in two minutes, another should be practised. It is insisted upon (Lafitte) that the water be injected at the painful points (*points douloureux*). There need be no limit to the number of the injections, if they afford relief; for, of course, no injury will result unless it be the occasional production of an abscess at the site of the injections.

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BLOODLETTING.

Venesection, arteriotomy, cupping, leeching.—The manner of bleeding, whether by opening a vein or an artery, is a surgical subject, which it is not necessary to consider in this work.

Physiological Actions.—Bloodletting may be employed for a systemic or local effect. Bleeding from a vein or an artery, by diminishing the whole quantity of the circulating fluid, and by altering its quality, affects the functions of every organ, and especially of organs the seat of an acute hyperæmia. Cupping and leeching, if carried far enough, may diminish the general blood-pressure and the proportion of the morphotic elements; but their action is largely local and revulsive.

The effects of blood-letting on the composition of the blood are these: the water is increased and the globules, fibrine, and salts, are diminished in relative amount; an artificial anæmia is thus induced. The action of the heart becomes more rapid and its force lessened; the arterial tension falls, and the pulse assumes the dicrotic character. The functions of organs, especially of the brain and nervous system, lose energy. Nausea, vomiting, faintness, syncope, and epileptoid seizures occur, when the loss of blood is considerable. Epileptiform convulsions is a constant phenomenon in animals bled to death (Kussmaul and Tenner).

When the quantity of fluid in the vessels is lessened by bleeding, thirst is experienced, and absorption is more rapid; the sensibility to pain is diminished, probably, because the perceptive centres are functionally inactive; and the power to evolve force, muscular, digestive, nervous, etc., is greatly restricted. Only one function, therefore, is rendered more active by bleeding; all the others are depressed in consequence of the inadequate supply of nutrient material.

It is a remarkable fact, perfectly well known to old practitioners, and to which Sir James Paget has recently called attention, that the ill-effects of bleeding, in healthy subjects, are very temporary and easily repaired. The blood-globules, which are relatively more affected by bleeding than the other constituents, are quickly reproduced, and the functions of organs suddenly very much depressed soon recover their normal energy. That any permanent injury is done to the healthy human system by a moderate bleeding seems, therefore, to be highly improbable.

Therapy.—The limits of this work will not permit the introduction of any controversial discussions. The author is to be ranked with those who do not employ general bloodletting, but he does not deny that it is occasionally useful; and that, indeed, it may be indispensable. A summary of the physical conditions in which venesection may be useful or indispensable should not, therefore, be omitted from a work on therapeutics.

The therapeutical effect of a general bloodletting in congestion and inflammation is largely mechanical. In *acute congestion of the lungs* when aëration of the blood is seriously impeded; when there are extensive stasis on the venous side, and ischæmia on the arterial side of the systemic circulation, great relief may be afforded by the abstraction of from four to sixteen ounces of blood. In the *apoplectiform variety of acute cerebral congestion*, damage to the brain may be prevented by letting blood. The effect of the bleeding is to diminish the intral-cranial pressure, and thus relieve the strain on the cerebral vessels. In *eclampsia*, especially of the puerperal variety, accompanied with the evidences of cerebral congestion, great relief may be procured by the timely abstraction of blood. The quantity of blood to be taken will depend in part on the character of the subject and on the amount of congestion.

The mechanical effect of the withdrawal of blood from the systemic circulation may be most advantageous in cases of *sudden over-distention of the right cavities of the heart.*

Pulmonary hæmorrhage, when dependent on acute congestion of the lungs, the general condition being one of plethora, may be promptly arrested by opening a vein in the arm.

The *pain* of *acute pleuritis*, and *acute peritonitis*, can be quickly relieved by bloodletting.

Although it is undeniable that the important results above mentioned may be obtained from general bleeding, it is equally certain that as good results in most of the conditions may be had by other methods. Acute diseases make such serious demands on the vital resources of patients, that the practitioner should seriously ponder the propriety of taking blood even in those cases to the relief of which it may seem to be adapted. Large bleedings, experience has abundantly shown, render the convalescence from acute diseases tedious—for the patient has to make up the losses by venesection as well as the ravages of the disease.

BLEEDING BY CUPS AND LEECHES.—A large number of cups and leeches may produce the systemic effects of a general bleeding. But, as a rule, these applications are intended to withdraw blood from the affected part, and thus act in the manner entitled revulsive. The local irritation caused by cups and leeches must, through the agency of the nervous system, affect distant parts in the same manner as other counter-irritants.

Leeches are preferable to cups when the parts are very sensitive, or inaccessible. The quantity of blood drawn can be more accurately measured when cups are used. The counter-irritant effects are much more pronounced from cups than from leeches.

The amount of blood drawn by a leech will depend on its size, and the subsequent loss of blood, when the bleeding is encouraged, is determined by the vascularity of the part. As a general rule it may be stated that a leech will draw about four times its own weight—about one to two drachms. To obtain from any given patient four ounces of blood, one ounce of leeches must be applied.

In *acute gastric, enteric, and peritoneal inflammations*, if the patient be plethoric, and there is decided sthenic reaction, leeches to the abdomen are very serviceable. The number to be applied will always depend on the effect to be produced, employing the rules given above as the basis of the estimate. In *typhlitis and perityphlitis*, the author has seen such good results produced by leeches, that he holds they should never be omitted when the tenderness and fever begin. In *acute hepatitis* and *congestion of the liver*, and in *acute dysentery*, the best results are obtained by the application of leeches to the margin of the anus. *Hæmorrhoids* that are swollen, painful, and irreducible without great suffering, are much relieved by the application of leeches directly to them. *Pruritus of the anus*, when due to engorgement of the portal circulation, and accompanied by heat of the anal region, may sometimes be cured by leeching the parts affected.

Acute desquamative nephritis, *pyelitis*, and *congestion of the kidneys*, are ameliorated by the application of cups to the lumbar region.

The following acute affections of the respiratory organs, when they occur in robust persons, and are accompanied by sthenic reaction, are favorably influenced in their course and duration by the application of cups or leeches—usually the former: *pleuritis*, *pericarditis*, *acute tonsillitis*, *acute laryngitis*, and *inflammatory croup*.

In *acute inflammations of the uterus and its appendages*, decisively good results are obtained by the application of leeches to the hypogastric region, to the iliac fossæ, or to the uterus.

Cupping the nape of the neck, or leeches to the mastoid process, are probably of service in acute congestion or inflammation of the intracranial structures; but the indiscriminate employment of bloodletting in any case of cerebral disease is to be condemned. The correct rule may be formulated as follows: When bloodletting is indicated in intracranial maladies, venesection or arteriotomy (temporal artery) is to be preferred to the use of cups or leeches.

Although good results are obtained by the local abstraction of blood in the diseases above mentioned, the author must express his conviction that the chief utility of cupping and leeching consists not in the blood withdrawn, but in the derivant and counter-irritant effect which they produce. *Dry cups*, a mustard-plaster, a turpentine-stupe, or other counter-irritant application, may render the painful process of cupping or leeching unnecessary.

ESCHAROTICS.

The substances belonging to this group are employed for the purpose of destroying the tissues to which they are applied. They differ in their mode of action, in the extent of the destruction which they effect, in their capacity for diffusion into the blood, and in the results which they severally accomplish.

They are prescribed for the purpose of cauterizing poisoned wounds —*syphilitic ulcers*, *snake-bites*, *the bites of rabid animals*—for the removal of *gangrenous parts*, *foul or exuberant granulations*, and especially for the destruction of *malignant growths*. When the diseased parts, to the destruction of which they are devoted, have been fully acted upon, the caustic action is ended; poultices are applied to favor the entire separation of the sloughs, and a healthy surface is finally left to heal by granulations.

The members of this group have, with one exception, been discussed elsewhere:

The mineral acids.
The chloride and sulphate of zinc.
Potassa fusa and potassa cum calce.
Arsenious acid.
The acid nitrate of mercury.
Bromine.

Acidum Chromicum.—Chromic acid. "In deep-red, needle-form crystals, deliquescent, and very soluble in water, forming an orange-red solution."

Actions and Uses.—Chromic acid is an oxidizing caustic. When the action ceases, sesquioxide of chromium remains. It is slow in action, and not very painful, but it penetrates deeply and is remarkably destructive. Small animals, as mice and birds, are dissolved entirely, bones and all, by chromic acid. Owing to the fact that it penetrates deeply without much pain, care must be used in its application as a caustic, lest it injure parts which are not intended to be affected. When it is applied as a caustic, the surrounding tissues must be well protected. For the destruction of *malignant growths*, *hæmorrhoids*, *warts*, etc., the acid should be made into a paste by the addition of sufficient water. The part to which it is applied first becomes yellow, then brownish, and ultimately black, and the eschar is detached in from twenty-four to forty-eight hours.

A solution of chromic acid of the strength of one hundred grains to an ounce of distilled water is an efficient local application in *syphilitic warts and vegetations*, *condylomata*, *lupus*, *sycosis*, *tinea tonsurans*, etc. A still stronger solution (grs. xv — ʒ j of hot water) has been injected into the uterine cavity with success in cases of *uterine hæmorrhage* and *uterine catarrh* (Wooster).

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EMOLLIENTS, DEMULCENTS, AND PROTECTIVE AGENTS.

Glycerina.—Glycerine. "A colorless, inodorous, sirupy liquid, of a sweet taste, and having the specific gravity of 1.25. It is soluble in water and in alcohol, but not in ether."

Glycerine-Ointment.—(Unofficinal.) (Spermaceti, ℥ ss; white wax, ʒ j; oil of almonds, ℥ ij; glycerine, ℥ j—add the glycerine to the melted ingredients, and stir briskly till cold) Squire.

Glyconine.—An emulsion of glycerine and the yelk of eggs—four parts of the yelks and five parts of glycerine.

Glycerine-Cream.—(Glycerine, 1; soft soap, 1; cherry-laurel water, 1) Squire.

Glycerine-Cream with Camphor.—(Glycerine, 2; camphor, 1; rectified spirit, 1) Squire.

Glycerina Amyli.—Glycerite of starch. (Starch, 1; glycerine, 8½) Ph. Br.

Properties.—Exposed to the air, glycerine slowly absorbs moisture, but it does not evaporate, and it does not become rancid or undergo fermentation spontaneously. It is unctuous to the touch, and is obstinately sticky. Glycerine possesses remarkable solvent powers. One part of iodine and one of iodide of potassium dissolve in two parts of glycerine. Bromine, the iodide of sulphur, the chlorides of potassium and sodium, the alkalies, some of the alkaline earths, many of the neutral salts, the vegetable acids, especially tannic, most of the alkaloids (morphia, quinia, strychnia, veratria, and atropia), and carbolic acid, are soluble in glycerine. The fatty acids, cocoa-butter, camphor, chloroform, calomel, iodide of lead, and the resins, do not dissolve in glycerine.

The antiseptic property of glycerine is decided. Vaccine lymph may be preserved unchanged almost indefinitely when stored up in pure glycerine; and anatomical preparations, and specimens of natural history, are kept in preservative solutions consisting chiefly of this substance. Microscopical and pathological specimens are after a time softened and disintegrated by pure glycerine.

Applied to the tissues of the body, glycerine, if pure, is perfectly bland and unirritating, as a rule, but in some subjects severe smarting is produced on contact of the purest glycerine with the mucous membrane. When it contains the fatty acids, oxalic or formic acids, it possesses very positive irritant qualities. It abstracts water from the tissues.

No systemic effects are produced by the stomach administration of glycerine. It does not impair or stimulate digestion, and sometimes acts as a laxative. It has but feeble nutritive quality.

Therapy.—Glycerine has been proposed and used as a substitute for cod-liver oil, in the various cachectic states in which the latter is prescribed. It has been conclusively shown that it is inferior to cod-liver oil in every respect. As a vehicle for the administration of cod-liver oil, it is extremely serviceable (glyconine, a teaspoonful; cod-liver oil, a teaspoonful; tincture of cinnamon, ten drops).

Good results have been reported from the use of glycerine in *diabetes*, but the data are as yet insufficient to enable a correct estimate of its real value to be made. The internal administration of glycerine has been resorted to for the removal of *acne*, with success; but the author's experience has not been so satisfactory.

The most important applications of glycerine, besides its numerous uses as a vehicle, are topical as an emollient. Applied to the affected mucous membrane by means of a camel's-hair pencil, pure glycerine affords great relief in *acute coryza. Chronic follicular pharyngitis*, accompanied with profuse secretion, is generally improved by the same application, but the addition of tannic acid greatly enhances its curative power in this affection. A solution of morphia in glycerine, applied to the fauces with a brush, relieves the *cough of phthisis.* A better application in many respects is a mixture of glycerine, crystallized sugar, and whiskey. This mixture, allowed to trickle slowly down the fauces, allays irritability and keeps the mucous membrane moist (glycerine, two parts; whiskey, one part; crystallized sugar, a sufficiency).

An enema of glycerine and infusion of flaxseed (one to four) allays the tenesmus in cases of *acute dysentery.*

For *chapped hands or face*, glyconine is an excellent application. In *seborrhœa*, glycerine-cream gives good results. For *fissures of the nipple*, Stillé strongly recommends a "liniment made by adding one part of tincture of benzoin to six or eight of glycerine, and filtering the mixture."

In *pityriasis* and in the *papular eruptions*, glycerine is serviceable, but, in general, it may be stated that its use in skin-diseases is disappointing, and that it is inferior as a local application to the usual oils and fats employed in this way.

Glycerine has been used as a dressing for *wounds* and *ulcerated surfaces*, with more or less advantage. It is largely prescribed by gynæcologists as a topical application to erosions and ulcerations of the cervix uteri, and for the relief of vaginal leucorrhœa.

The glycerite of starch (plasma) is an excellent vehicle for the application of astringents to the eye, and is much employed by ophthalmologists for this purpose. Glycerine is used by otologists to soften cerumen, to entangle insects which have entered the ear, to diminish the secretion of pus, and to relieve the morbid state of the auditory canal in cases of otorrhœa.

Collodium.—Collodion. "Is a slightly opalescent liquid, of a sirupy consistence. By long standing it deposits a layer of fibrous matter, and becomes more transparent. This layer should be reincorporated, by agitation, before the collodion is used. When applied it should form a colorless, transparent, flexible, and strongly contractile film."

Collodium Flexile.—Flexible collodion. (Collodion, Canada turpentine, castor-oil.)

Liquor Gutta-Perchæ. — Solution of gutta-percha. (Gutta-percha, carbonate of lead, purified chloroform.)

ACTIONS AND USES.—These solutions, when applied to the integument, evaporate, leaving a transparent film or coating impervious to air and moisture. In drying collodion contracts energetically, and may indeed produce such a degree of constriction as to cause pain, and to render the part bloodless. Flexible collodion contains turpentine and castor-oil, which confer the property of flexibility, while they do not impair the impermeability of the film. The solution of gutta-percha has properties similar to flexible collodion.

These solutions are employed to protect exposed parts from the contact of air, to secure primary union of incised wounds, to cause resolution of inflamed parts by mechanical pressure, etc.

Some cases of *chronic tubercular and squamous skin-diseases* are much improved by coating them with the gutta-percha solution. Previous to the application of the solution all scales should be removed. Excellent results have been obtained in *herpes zoster* by a thick coating of the flexible collodion, or the gutta-percha solution: the pain is relieved, the vesicles aborted, and the duration of the disease shortened. As this is a self-limited disease, there must remain a suspicion of *post hoc* rather than *propter hoc. Erysipelas*, especially of the traumatic variety, is, at least, much relieved as regards the local symptoms by a thick coating of flexible collodion, but there is no evidence that it actually shortens the duration of the disease. *Burns to the first degree* are greatly benefited by the same application; it prevents contact of the air, and allays the irritation and pain. When, however, there is much exudation, or sloughing takes place, an impermeable coating adds to the distress.

Collodion has been used without much success in *small-pox*, to hinder the development of the pustules. *Small boils*, *carbuncles*, *nævi*, and even superficially placed *aneurisms*, may be so compressed as to arrest the local inflammation or to cause coagulation of the blood. *Orchitis* may be treated by a coating of collodion, instead of strapping. When the mechanical effects of the collodion are to be obtained, successive layers must be applied.

Fissures of the nipples are best treated by flexible collodion or gutta-percha solution. The fissures are carefully wiped dry, well approximated, and then thoroughly coated. Nipples that are retracted may be made more prominent by surrounding them, after being well drawn out, with a thick layer of collodion so placed that on contracting it will pucker the skin of the areola.

Collodion has been used with success as a means of compression in *umbilical hernia*, *spina-bifida*, *varicocele*, etc.

Chondrus.—*Chondrus Crispus.* Irish moss.

Cetraria.—*Cetraria Islandica.* Iceland moss.

Decoctum Cetrariæ.—Decoction of Iceland moss.

COMPOSITION.—The principal constituent of chondrus is a mucilage, which, when dry, is horny, but swells up in water forming a jelly. Cetraria contains about seventy per cent. of a starch (lichen-starch), a decoction of which gelatinizes on cooling. In addition to this starch cetraria contains a bitter principle (cetrarin), and a peculiar acid (licheno-stearic acid).

These lichens are used only for the production of diets for the sick. They were formerly supposed to possess some peculiar virtues which rendered them serviceable to pulmonary invalids. As articles of food, they have a very low position as regards nutritive value. The decoction of cetraria may be used as a stomachic tonic, containing as it does a bitter principle; but it is only to be prescribed when the more efficient remedies are not well borne.

Chondrus may be made into jelly or *blanc mange*, in the same way as gelatine is now prepared for this purpose. Neligan gives the following recipe for the preparation of a jelly from chondrus: Chondrus, washed and macerated, thirty grains; spring-water, a pint; boil down to one-half and strain with expression, and add to the strained liquor four ounces of white sugar, one ounce of gum-acacia, and thirty grains of powdered orris-root; heat to dryness with a gentle temperature, stirring constantly so as to obtain a pulverulent mass, to which three ounces of arrow-root are to be added by trituration. A jelly is prepared with this powder by rubbing a teaspoonful of it with a little cold water, and then pouring a cupful of boiling water on it.

Acacia.—Gum-arabic. "A gummy exudation from acacia vera, and other species of acacia."

Mucilago Acaciæ.—Mucilage of gum-arabic.

Syrupus Acaciæ.—Sirup of gum-arabic.

Tragacantha.—Tragacanth. "The gummy exudation from astragalus verus, and from other species of astragalus."

Mucilago Tragacanthæ.—Mucilage of tragacanth.

Sassafras Medulla.—"The pith of the stems of sassafras officinale.'

Mucilago Sassafras Medullæ.—Mucilage of sassafras-pith.

ACTIONS AND USES.—These preparations are used as demulcent drinks, in cases of acute inflammation of the stomach and intestines. They are supposed to make a protective coating on the inflamed part, and thus save it from further injury. They are especially indicated when irritating and corrosive substances have been swallowed. They are also frequently prescribed as diet-drinks in fevers and in acute inflammations, in accordance with the supposition that they are not only soothing to the alimentary canal but are, in a limited sense, foods. As nutrients these gums and mucilaginous substances rank very low, and can by no means take the place of such a food as milk. Furthermore they are exceedingly apt to undergo fermentation, and to produce flatulent colic and diarrhœa.

Mucilaginous drinks are very frequently taken in catarrhal affections of the bronchial tubes and of the kidneys, with the view to modify the morbid process going on in these parts. It need hardly be stated that such a theory of the utility of demulcents is erroneous. Cough is modified by an influence which is probably reflex, when mucilages are applied to the fauces; but in no other way can the mucous membrane of the air-passages be affected by such remedies taken into the stomach. As gums undergo digestion in the alimentary canal, it is obvious that they cannot act as demulcents on any part of the urinary tract.

The chief use of these remedies is in extemporaneous prescriptions, to hold insoluble medicines in suspension, and to cover the taste of disagreeable ingredients.

Linum.—Flaxseed. "The seed of linum usitatissimum."

Lini Farina.—Flaxseed-meal.

Infusum Lini Compositum. — Compound infusion of flaxseed. (Flaxseed, ℥ ss; liquorice-root, ʒ ij; boiling water, Oj.)

Ulmus.—Slippery-elm bark. "The inner bark of ulmus fulva."

Mucilago Ulmi.—Mucilage of slippery-elm bark.

Glycyrrhiza.—Liquorice-root. "The root of glycyrrhiza glabra.

Extractum Glycyrrhizæ.—Extract of glycyrrhiza (liquorice).

Mistura Glycyrrhizæ Composita. — Compound liquorice-mixture (brown mixture). A simple expectorant containing paregoric, wine of antimony, and spirits of nitrous ether. Dose, ʒ j — ℥ ss.

Actions and Uses.—The remedies of this group contain mucilaginous constituents on which their properties depend. They are frequently prescribed as protectives in gastro-intestinal disorders, and as expectorants in bronchial affections.

Poultices.—Flaxseed-meal, powdered slippery-elm bark, and Indian or corn meal, are most frequently used for the preparation of poultices. Wheat-bread and milk are also occasionally employed for the same purpose.

In the preparation of a poultice, the meal is slowly incorporated with hot water, until a mass of the proper consistency is made. The mixture itself should not be applied immediately to the part, for it dries and adheres with considerable tenacity. A piece of washed muslin of quadrangular shape, and of sufficient size, is selected; the hot mass is spread on one end of the muslin, leaving a margin of one inch on three sides; the long end of the muslin is then folded over the mass, and the free margins are stitched or pinned together. If the poultice is not frequently renewed, to prevent drying, some glycerine should be added to the surface which is to remain in contact with the tissues. Laudanum, or other narcotics, may be stirred in with the meal if the relief of pain be desirable.

A *yeast-poultice* consists of brewers' yeast, to which sufficient flaxseed is added to give the proper consistence.

A *charcoal-poultice* differs from an ordinary poultice in having powdered charcoal incorporated with the mass. In order that a charcoal-poultice shall have the proper consistence, the mass should be thin enough to take up a sufficient quantity of charcoal.

ACTIONS AND USES.—A poultice is a means of applying continuous heat with moisture, and of softening the tissues. An afflux of blood takes place to the part, the vessels dilate, the tissues, softened by the combined influence of heat and moisture, permit the easy diffusion of the fluids. If the process of inflammation has begun, or is in progress, the stasis is relieved, the tension of the inflamed part is lessened, and resolution is thus favored; or, if the stage of exudation is reached, the migration and multiplication of the white corpuscles are promoted, and the extrusion of purulent elements facilitated. The accumulation of blood in the neighborhood of the poultice seems to diminish the pressure elsewhere, and thus poultices of large size lower the arterial tension and lessen stasis in internal parts. Poultices relieve the pain of inflamed parts by relaxing the tissues, and thus removing pressure from the sensory nerve-filaments. The impression thus made on the peripheral nerve-endings is transmitted to the centre and reflected over internal organs. It is within the range of everybody's personal experience that warm, moist applications relieve pain in internal and distant parts, which have no anatomical connection with the integument to which the applications are made.

Poultices have, therefore, a local and a systemic effect. Their therapeutical uses are based on this conception of their physiological actions. They are prescribed to relieve the tension and to promote resolution or suppuration in *boils*, *carbuncles*, and other *superficial inflammations*, to hasten the healing of *irritable ulcers*, to favor the separation of *gangrenous sloughs*, etc. Foul-smelling wounds requiring the use of poultices are best treated with the yeast or charcoal poultice.

Unquestionable benefit is derived from the application of hot poultices externally in *acute faucial inflammations*, in *pneumonia*, *pleuritis*, *pericarditis*, *hepatitis*, *peritonitis*, etc.

The application of poultices sometimes degenerates into abuse. If too long continued, the skin becomes white, wrinkled, and sodden; small abscesses or boils form, and the vessels of the parts very slowly regain their tone. If kept too long in contact with wounds or ulcerated surfaces, the granulations become pale and flabby, and the healing process is retarded. Applied indiscreetly to inflamed joints, they may promote suppuration, and thus permanently injure these structures. If kept long in contact with a large extent of surface, they will lower the general tone and vigor of the system, depress the systemic circulation, exhaust the irritability of the vaso-motor nerves, and thus seriously embarrass the reparative process, if not wholly prevent repair.

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